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National Petroleum Reserve-Alaska
Integrated Activity Plan Environmental Impact Statement

Volume 3: Chapter 4 (Sections 4.5-4.7)

Alaska

U.S. Department of the Interior
Bureau of Land Management

The Bureau of Land Management Today

Our Vision

To enhance the quality of life for all citizens through the balanced stewardship of America's public lands and resources.

Our Mission

To sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

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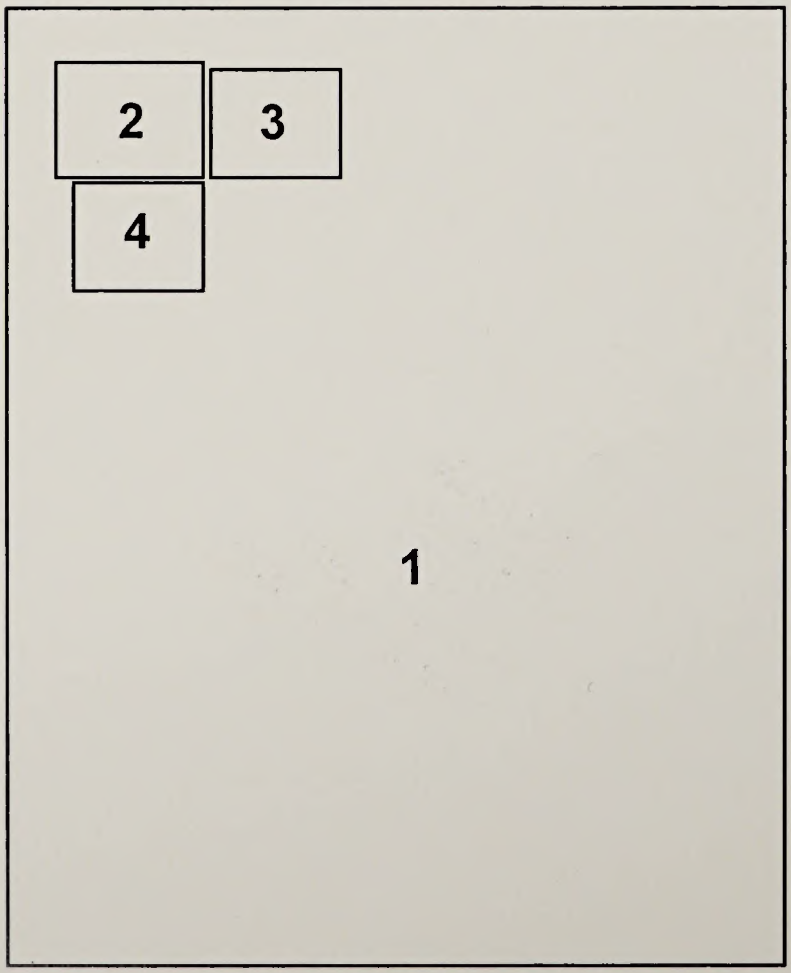

Cover Photos:

1. Along the Archimedes Ridge in the Utukok River Uplands of the National Petroleum Reserve-Alaska. © Patrick Endres

2. Winter petroleum exploration, National Petroleum Reserve-Alaska. Photo by NSSI

3. Polar Bear, North Slope, Alaska.

4. Two newly born caribou calves in the Utukok River Uplands of the National Petroleum Reserve-Alaska. © Patrick Endres

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National Petroleum Reserve-Alaska

FINAL

Integrated Activity Plan/ Environmental Impact Statement

Volume 3
Chapter 4 (sections 4.5 to 4.7)

Prepared by:

U.S. Department of the Interior
Bureau of Land Management
Anchorage, Alaska

In cooperation with:

North Slope Borough
U.S. Bureau of Ocean Energy Management
U.S. Fish and Wildlife Service

November 2012

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How the IAP/EIS is Organized

VOLUME 1

Chapter 1 – Introduction: Summarizes the purpose of and need for this IAP/EIS and decisions to be made.

Chapter 2 – Alternatives: Describes and compares proposed management alternatives.

Chapter 3 – Affected Environment: Presents existing natural and socioeconomic resources in the NPR-A and trends, including those associated with climate change.

VOLUME 2

Chapter 4 – Environmental Consequences (sections 4.1 – 4.4): Provides the assumptions upon which the impact analysis rests and evaluates impacts of Alternatives A and B-1 on resources and uses in the NPR-A relevant to making a decision among the alternatives.

VOLUME 3

Chapter 4 – Environmental Consequences continued (sections 4.5 – 4.7): Evaluates impacts of Alternatives B-2 (preferred alternative), C, and D on resources and uses in the NPR-A relevant to making a decision among the alternatives.

VOLUME 4

Chapter 4 – Environmental Consequences continued (sections 4.8 – 4.13): Evaluates the cumulative impacts on resources and uses in the NPR-A and other effects relevant to making a decision among the alternatives.

VOLUME 5

Chapter 5 – Consultation and Coordination: Describes public and government (including tribal) consultation undertaken for this plan and the development of alternatives and lists the plan's preparers.

Chapter 6 – Comments and Responses: Presents public comments on the Draft IAP/EIS and responses to the comments.

VOLUME 6

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Appendix B: Federal, State, and Local Permits and/or Approvals for Oil and Gas Exploration, Development, and Production Activities

Appendix C: NPR-A Climate Change Analysis: An Assessment of Climate Change Variables in the National Petroleum Reserve in Alaska

Appendix D: Essential Fish Habitat

Appendix E: Common, Scientific and Iñupiaq Names of Species Listed in the IAP/EIS

Appendix F: BLM Sensitive Species List for Alaska

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Section 4.5:

Impacts of Alternative B-2

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES (continued)

4.5 Alternative B-2

4.5.1 Air Quality and Climate

This section qualitatively describes the potential air quality impacts associated with Alternative B-2.

4.5.1.1 Activities Not Associated With Oil and Gas Exploration and Development

Air quality impacts associated with these activities are the same as those associated with Alternative A, discussed in section 4.3.1.1 in Volume 2.

4.5.1.2 Oil and Gas Exploration and Development Activities—Air Pollutant Emission Sources

The air pollutant emission sources and effects of air pollution are the same as those associated with Alternative A, discussed in section 4.3.1.2 in Volume 2.

Development and production activities can also produce fugitive dust emissions (primarily as PM_{10}). Fugitive dust occurs primarily during the summer months due to driving on unpaved roads. Vehicles can also track out fine material from gravel mining operations in the winter and summer months. Potential control measures include limiting vehicle speeds, and treating problematic road sections with surfactants or water.

Well closure, abandonment, and reclamation activities would emit air pollutants similarly to those during development (construction), since similar vehicles and other emission sources would be used. Because closure activity would not occur at a single location for any substantial length of time, the impact of air emissions at any single location would likely be short term. Impacts could be minimized by leaving gravel on-site, limiting the amount of transport. Once reclamation is complete, production facilities would no longer impact air quality in the planning area (USDOI BLM 2008).

4.5.1.3 Effectiveness of Stipulations and Best Management Practices

Best Management Practice A-9 requires that all oil and gas operations that burn diesel fuels use ultra-low sulfur diesel as defined by the Alaska Department of Environmental Conservation-Division of Air Quality. Effective December 1, 2010, the Alaska Department of Environmental Conservation adopted the EPA regulation that requires the use of ultra-low sulfur diesel fuel in all vehicles and equipment. This requirement would apply to all BLM-authorized oil and gas operations (including contractor vehicles and equipment).

Best Management Practice A-10 would provide substantial protection for air quality within the NPR-A. Pre- and post-project ambient air quality monitoring would provide an understanding of air quality in the NPR-A relative to standards and thresholds. Air quality modeling would provide an estimate of potential post-project impacts and could provide guidance on the most effective pollution control strategies to employ once the project is completed.

Consistent with 40 CFR Part 69, beginning on December 1, 2010, the diesel fuel that is designated for use in rural Alaska for all on-road and non-road vehicles and equipment, locomotive, and marine will be ultra-low sulfur diesel fuel (15 parts per million sulfur). Ultra-low sulfur diesel was designated for use for on-road vehicles in urban Alaska on October 15, 2006; for non-road vehicles and equipment on December 1, 2010; and will be designated for locomotive and marine vehicles on December 1, 2012. Urban Alaska is defined as those geographical areas of Alaska designated by the State of Alaska as being accessible by the Federal Aid Highway System. Areas not accessible by the Federal Aid Highway System are considered rural (Elson 2011).

As a trace constituent in diesel fuel, sulfur compounds may cause adverse air quality impacts through formation of sulfate particulate matter (affecting visibility) and deposition of acidic aerosols. These impacts would be reduced significantly by utilizing ultra-low sulfur diesel fuel. In addition, ultra-low sulfur diesel fuels burn cleaner and produce less light absorbing carbon particulate matter (soot, also called black carbon). When burned, ultra-low sulfur diesel emissions are much lower than those generated by previous fuels, reducing fine particulate (soot), sulfuric acid, and sulfate (visibility) impacts.

4.5.1.4 Conclusion

Exploration, development, and production activities are expected to cause increases in the concentrations of criteria pollutants, hazardous air pollutants, volatile organic compounds, and greenhouse gases. Emissions and resulting air quality impacts from Alternative B-2 (the preferred alternative) are expected to be the second lowest (behind Alternative B-1) compared to the other alternatives due to substantially less federally owned subsurface being available for oil and gas leasing compared to Alternatives C and D, and slightly less compared to Alternative A. As a result, air pollution would be roughly proportionately reduced compared to Alternatives A, C, and D and proportionately increased compared to Alternative B-1.

For a discussion of air quality modeling analyses, see section 4.3.1.4 and Appendix H. The BLM modified best management practice A-10 in the Final IAP/EIS to better address potential air quality impacts.

4.5.2 Paleontological Resources

4.5.2.1 Activities Not Associated With Oil and Gas Exploration and Development

In regard to the types of activities that generate potential impacts to paleontological resources, under Alternative B-2 they are essentially the same as those that could take place under Alternative B-1. This is because the primary difference between Alternatives

B-1 and B-2 are in protection designations rather than the amount of area that would be open to oil and gas exploration, development and production.

Under Alternative B-2, the types of non-oil and gas activities would be the same as those described for Alternative A (section 4.3.2.1 in Volume 2), and the potential impacts to paleontological resources would also be similar.

4.5.2.2 Oil and Gas Exploration and Development Activities

Effects of Seismic Surveys

Under Alternative B-2, the level of seismic activity could increase slightly over that of Alternative A (4.3.2.2 in Volume 2) in regard to 3-D activities. It is anticipated that there could be an increase of as much as 4,456 survey/camp train miles, about 8 percent, and 43,345 surveying/camp train acres, (8 percent). However, given the low probability of impact from seismic activity, this is not regarded as a meaningful increase in terms of potential impact to paleontological resources. Therefore, the probability of encountering and impacting scientifically significant paleontological material under Alternative B-2 remains low.

Effects of Short-term Disturbance: Exploration and Delineation Drilling

Short-term impact producing activities include drill pads, roads, and airstrips constructed of ice and snow. Under Alternative B-2, all of these activities are reduced to approximately 251,000 acres; a decrease of about 23 percent compared to Alternative A (section 4.3.2.2 in Volume 2). Under Alternative A, the potential adverse impact to paleontological resources from short-term disturbance is low. Under Alternative B-2, where less land is available for leasing and the amount of potentially impacting activities is substantially reduced, the potential for adverse impact remains low.

Effects of Long-term Disturbance: Development of Oil and Gas Infrastructure

Under Alternative B-2, the amount of potential disturbance from construction of central processing facilities and associated satellite pads, roads, airstrips, pump/compressor stations, and gravel pits in regard to surface area is reduced to 8,402 acres, which is 1,500 acres (27 percent) less than Alternative A. Gravel extraction would be reduced by about 9 million cubic yards (22 percent) of gravel mined compared to that of Alternative A. Also by comparison, the number of potential vertical support members is reduced to 49,005, which is 26 percent less than Alternative A. Gas pipeline trenching increases by 57 miles (9 percent) adding 228,000 cubic yards to the total excavated material. Overall, excavation, the activity that is most likely to adversely impact paleontological material, would be reduced substantially under Alternative B-2.

Effects of Oil Spills and Gas Releases

Under Alternative B-2, the effects of spills on paleontological resources would be essentially the same as discussed under Alternative A. However, since there would be fewer wells drilled and less infrastructure developed under Alternative B-2, the probability of encountering and impacting paleontological material is reduced. As previously described (section 4.3.2.2 in Volume 2), there would probably be no adverse effect on paleontological resources from a gas release.

Effects of Abandonment and Reclamation

Abandonment and reclamation of short-term and long-term infrastructure, under most circumstances, would have limited if any impact on paleontological resources (see section 4.3.2.2 in Volume 2).

4.5.2.3 Effectiveness of Stipulations and Best Management Practice

Under Alternative B-2, the primary safeguard for paleontological resources is Best Management Practice E-13, which states that lessees will conduct a paleontological resources survey prior to engaging in any potential ground-disturbing activity.

4.5.2.4 Conclusion

The primary potential impact to paleontological resources would result from the excavation of gravel for construction of the permanent facilities. However, surveys for paleontological resources are required to be conducted before excavation or any potential ground-disturbing activities could take place. Considering the variability of distribution, density, and context of paleontological resources in the NPR-A and the overall effectiveness of the protection, non-oil and gas and oil and gas activity have a very low probability of adversely impacting paleontological resources. The potential effect of climate change is the same as described for Alternative A.

4.5.3 Soil Resources

4.5.3.1 Activities Not Associated with Oil and Gas Exploration and Development

Various types of activities not related to oil and gas leasing and development, including private or commercial air traffic, summer research camps, use of off-highway vehicles, recreational camps, paleontological and archaeological excavations, and overland moves could affect soil resources in the planning area under Alternative B-2.

Under Alternative B-2, impacts associated with non-oil and gas activities would be similar to those described under Alternative A. These activities could occur throughout the planning area and would be little affected by the decreased availability of land for oil and gas leasing.

4.5.3.2 Oil and Gas Exploration and Development Activities

The following analysis is based on section 4.2.1.2, "Oil and Gas Exploration and Development Activities" in Volume 2. See that section for a discussion of estimates and assumptions for development, as well as a description of how estimated areas of disturbance were calculated for each alternative.

During oil and gas exploration and development, various activities could cause impacts to soil resources in the planning area. These activities include seismic activities; construction and use of gravel pads, gravel roads, gravel airstrips, and pipelines; excavation of material sites; construction of ice roads and ice pads; and summer tundra travel. Impacts could also occur from oil spills and from removal of gravel pads and gravel roads during reclamation. These activities would impact soil productivity and could alter the moisture regime of tundra near the structure by changing natural drainage patterns and areas where snow accumulates and amount of heat that is absorbed by the surrounding areas. Types of impacts to soil resources for Alternative B-2 would be similar to those described for Alternative A. Descriptions of differences in the magnitude and area of impacts for Alternative B-2 are below.

Effects of Disturbances

Seismic Surveys

Effects to soils from seismic surveys would be the same as for Alternative A. Under both alternatives, it is projected that one 2-D and ten 3-D surveys would be done to fill in gaps in existing survey and monitor remaining reserves. Since vegetative cover would be minimally impacted, soil disturbance is projected to be minimal. Short-term soil disturbance from 2-D and 3-D operations combined would total a maximum of 581,397 acres (2.5 percent of the 22.8 million-acre NPR-A). Long-term disturbance to soils total approximately 1,670 acres.

Exploration

Under Alternative B-2, impacts to soil from activities associated with oil and gas exploration would be similar to those described for the Alternative A. It is anticipated that under Alternative B-2 there would be fewer exploration and delineation wells drilled, which would result in lower impacts to soil resulting from the construction of multi- and single-year ice pads (6 acres each), ice roads, and well collars.

During the life of the plan, it is assumed that 76 exploration wells and the same number of delineation wells, or a total of 152 wells for both oil and gas, would be drilled from ice pads in the NPR-A under Alternative B-2. At 6 acres per pad, 912 acres of tundra spread out over 30 years would be impacted (a reduction of 22 percent, compared to Alternative A).

Under Alternative B-2, ice road and snow trail construction would also be less than in Alternative A in terms of total miles. The total acreage of short-term disturbance from ice roads and snow trails over 30 years would be 249,246 acres, about 22 percent less than for Alternative A. Since soil disturbance is minimal, recovery from ice road impacts is expected within a few years (Yokel et al. 2007); long-term disturbance from ice roads would be negligible. Although some evidence of crushed tussocks may still be apparent, new growth would preclude any exposed soils.

Ice airstrips are also used during exploratory drilling, and under Alternative B-2, it is assumed that 65 ice airstrips would be constructed, covering 11 acres each for a total of 715 acres (35 percent less than under Alternative A). These airstrips are commonly built on the grounded ice of large lakes, but if they were built over tundra, they would result in impacts similar to ice roads.

The construction of well cellars during exploration requires the digging of a hole that destroys soil on approximately 64 square feet (0.0015 acre) of ground. Thermokarst associated with the disruption of thermal regime in the surrounding soil may also change the soil properties type around the well cellar to a wetter regime. These impacts could result in 0.2 acre of soil being destroyed under Alternative B-2 (33 percent less than under Alternative A).

Development and Production

During oil and gas development and production, various activities could cause impacts to soils in the NPR-A. These activities include construction and use of gravel pads, roads, airstrips, and pipelines; excavation of material sites; and construction of ice roads and ice pads. Ice roads and pads are covered above.

Placement of Gravel Fill

Types of impacts to soils from placement of gravel fill would be similar to those in Alternative A. Construction of central processing facilities and central gas facilities with associated satellite pads, roads, staging areas, and airstrips, and three staging bases would be developed, resulting in the loss of soil productivity in the areas of gravel placement. Under this alternative, it is estimated 5,624 acres of soils buried by gravel placement (20 percent less than under Alternative A).

The decreased facilities construction and use under Alternative B-2 would result in a smaller area impacted by dust than under Alternative A. Assuming a total of 566 miles of in-field gravel roads and 29 airstrips (27.5 miles), there is a potential for a total perimeter of 1,187 miles. Within 30 feet of gravel fill, up to 4,316 acres could be subject to loess soil depositions by dust and gravel, and another 17,265 acres could be affected by a dust shadow that affects out to 150 feet.

Construction of central processing facilities and associated gravel pads, roads, staging areas, and airstrips could alter the moisture regime of tundra near the structure by changing natural drainage patterns and areas where snow accumulates. Snowdrifts caused by gravel structures would increase the wintertime soil surface temperature and increase thaw depth in soils near the structures. Dust deposition and the formation of impoundments would exacerbate these impacts. These factors could combine to warm the soil, deepen thaw, and produce thermokarst adjacent to roads and other gravel structures (National Research Council 2003). In flat, thaw-lake plains on the North Slope, gravel construction can be anticipated to result in upslope water impoundment and thermokarst erosion equivalent to the area directly covered by gravel (Walker et al. 1987). In general, most changes in the soil profiles around gravel structures would occur within 164 feet of the structure. If all effects were to occur within this zone, a maximum of 23,596 acres would be impacted under Alternative B-2 (20 percent less than under Alternative A). Note that this area includes the 21,581 acres affected by dust above, and is not in addition to it.

Material Sites

Gravel required for development in the planning area could be mined from existing sites east of the NPR-A or could be extracted from new sites developed within the planning area. Investigations to identify gravel sources in the planning area have not been conducted, but presumably would be initiated if discoveries of recoverable oil or gas were made. Under Alternative B-2, it is assumed that up to 31 material sites would be needed, covering a total area of 1,125 acres (21 percent less than under Alternative A). Excavation of the gravel mine and stockpiling of overburden would remove soil and impact soil productivity at these sites.

Pipelines

Under Alternative B-2, given the potentially fewer number of fields developed, impacts from pipeline construction would be less than those described for Alternative A. Pipelines on the North Slope are typically built on vertical support members with a diameter of 12 inches and a spacing of 150 vertical support members per mile. About 6 percent of this area would have soils replaced by the vertical support members, and the remaining portion would be potentially altered in terms of soil profiles and composition. Approximately 0.05 acre of soil would be disturbed per pipeline mile for oil gathering pipelines, and 0.03 acre per mile of regional oil pipelines. Under Alternative B-2, 154 miles of gathering lines for oil, and 451 miles of regional oil pipelines would disturb about 21.2 acres of soil through vertical support member placement, or about 27 percent less than under Alternative A. Ice roads built for construction of these pipelines would have short-term impacts to soil on less than 2,565 acres. In reality, some of the vertical support members for gathering lines would be over gravel pads and would have no additional impacts on soils, nor would ice roads be necessary for construction of these portions of pipeline. It is assumed that gas pipelines would be buried, so impacts to soils would be different than for oil pipelines. In the case of buried gathering, regional and high-pressure gas pipelines, short-term disturbance from ice roads would affect 3,804 acres. Long-term impacts from trenching and spoils storage would occur on 1,633 acres.

Summer Tundra Travel

On a case-by-case basis, the BLM may permit low-ground-pressure vehicles to travel off gravel pads and roads during periods other than when the ground is frozen and covered with snow. This would be an uncommon occurrence, and if permitted at all, it would likely be only during late summer to fall. Because of restrictions on this activity, impacts to soils should be limited to the compression of standing vegetation, similar to what happens during winter following traffic by low-ground-pressure vehicles. Some of these uses may adversely affect small areas of wet ground, in particular, causing changes in vegetative cover that may initiate subsidence along the travelled route.

Summer vehicle tundra travel is commonly associated with spill prevention and preparedness measures required in spill prevention plans. Each summer season, low-ground-pressure vehicles might be used to transport and place booms across streams downstream from pipelines. These booms are left in place through the summer to capture any oil that might spill from a pipeline and then would be retrieved, again probably using low-ground-pressure vehicles, before freeze-up. Pipeline inspections may also entail summer vehicle travel on the tundra. Finally, periodically, spill response training may occur along and downstream from pipelines in summer.

As a rule, summer tundra travel for exploration and development would not be permitted under Alternative A. Therefore, given the potentially fewer number of fields developed and allowance of summer tundra travel under certain circumstances, impacts from summer tundra travel under Alternative B-2 should be greater than in Alternative A. Short-term, minor impacts to soils are expected from limited summer tundra travel using low-ground-pressure vehicles. However, Best Management Practice L-1 is designed to regulate and monitor summer travel and minimize impacts to soils and vegetation. Summer travel would only be permitted on a case-by-case basis if the applicant can demonstrate that the proposed use would have no more than minimal impacts to soils and vegetation.

Abandonment and Reclamation

Types of impacts from abandonment and reclamation would be the same as those described in Alternative A. Under Alternative B-2, it is expected that fewer structures would be constructed for oil and gas activities as compared to Alternative A (Table 4-14 in Volume 2). Therefore, the amount of reclamation required, and impacts to soils from abandonment and reclamation, would be less than under Alternative A.

Effects of Oil and Gas Development on Permafrost

Types of impacts to permafrost from oil and gas development would be the same as those described in Alternative A. Under Alternative B-2, less surface disturbance is expected from oil and gas activities as compared to Alternative A. Therefore, there would be less area of permafrost potentially affected.

Effects of Spills

Effects of spills on soils would be similar to those in Alternative A. Under Alternative B-2, impacts to soils from oil spills could be somewhat less than in Alternative A, as the estimated number of large and small spills is slightly lower (see section 4.2.2.1, "Oil Spills" in Volume 2). The probability of a large oil spill occurring would also be less under Alternative B-2; but for analysis, the assumption remains at one large spill.

Most oil spills cover less than 500 square feet (less than 0.01 acre); although a pressured aerial mist may cover up to 145 acres (Ott 1997). (Such a spill is a very low probability event, occurring less than once out of the total spills expected throughout the life of this plan. Thus, its magnitude is not apparent in the following acreages.) If 11 percent of all oil spills would reach soil during summer, under Alternative B-2 this would mean 40 of the 368 crude and refined oil spills assumed to occur over the life of the plan would have more than a negligible effect on soil conditions. Assuming the average spill would cover 0.1 acre, under Alternative B-2 approximately 4 acres would be impacted substantially during the lifetime of development in the NPR-A. This is about 26 percent less than the acreage impacted under Alternative A. Overall, past spills on Alaska's North Slope have resulted in minor ecological damage, and ecosystems have shown good potential for recovery (Jorgenson 1997).

A single gas release occurring with ignition could have thermal effects to approximately 194 acres of tundra soils (500-meter radius). The assumed number of gas releases under Alternative B-2 (2.7 = 897 miles of pipe at a rate of 0.9 incidents per 300 pipe miles), if ignited, would result in thermal effects to approximately 504 acres. If a wildfire resulted, additional acreage would burn, the amount depending on season, weather conditions, moisture content of organic layers, and suppression effort. Of the 22 instances of North Slope tundra fires between 1955 and 2007, most were less than 1,000 acres (Racine and Jandt 2008). Total vascular plant cover of bare soils following lightning-caused tundra fires reached 50 to 100 percent after 5 to 6 years (Racine et al. 1987). High-intensity fire may destroy both soil structure and soil organic matter, which would require pedogenesis to restart with invasion by lichens. Lichens, however, could take several decades to recover if they can achieve former densities at all under a climate-warming regime (Jandt et al. 2008).

Commercial Gas Development

The types of impacts on soils that natural gas development and production would cause under Alternative B-2 would be the same as those caused by oil development described above, except that there would be no crude-oil spills. Because the length of buried gas pipeline and the single standalone compressor station would be the same as projected for Alternative A, it is anticipated that gas development would cause similar impacts as Alternative A.

4.5.3.3 Effectiveness of Stipulations and Best Management Practices

To protect soils in the planning area, the approval of most proposals for summer operations are limited. Because of the fragile nature of thawed tundra during the summer, permit sites are restricted to durable areas such as gravel bars, beaches, or existing gravel pads. Vehicles allowed for use in overland moves would exert low ground pressure and be permitted to travel only over snow-covered ground frozen to a sufficient depth to minimize soil and vegetation impacts. Many of the lease stipulations and best management practices under Alternative B-2 directly or indirectly limit potential impacts to soils in the planning area. Lease stipulations and best management practices developed to protect soil under Alternative B-2 would provide similar protection to soil resources as the stipulations developed for Alternative A.

Many of the lease stipulations and best management practices under Alternative B-2 would directly or indirectly limit potential impacts to soils in the planning area. Best Management Practices A-1 through A-7 relate to waste prevention, handling, disposal, spills, and public safety. These best management practices would be effective in ensuring that waste materials associated with exploration and development activities were properly disposed of, and helping to prevent impacts to soils from spills and mishandling of materials. They would also provide for rapid cleanup of spills, which would decrease the likelihood of impacts to soils from spills. Best Management Practices A-9 and A-10 would reduce air pollution. Best Management Practice C-2 on overland moves and seismic work would also effectively minimize impacts to the vegetative layer that protects the soil.

Lease Stipulation D-1 would effectively protect riparian habitat by preventing exploratory drilling in rivers, streams, and active floodplains. Lease Stipulation D-2 would effectively minimize surface impacts from exploratory drilling by limiting activities to temporary structures such as ice pads, ice roads, ice airstrips, and temporary platforms, unless permanent structures were absolutely required. Lease Stipulation E-2 and Best Management Practices E-4, E-5, E-6, E-8, and E-12 would effectively minimize impacts to soils by providing facility design and construction regulations that would limit the footprint of developments, provide protection from oil spills, provide setbacks that protect riparian and other high value habitats, and ensure that habitat and resource issues were considered in the placement of facilities. Lease Stipulation G-1 would facilitate the retention of soil properties to encourage rapid regrowth following facility abandonment The setbacks outlined in lease stipulations (K-1, K-2, K-3, K-7 and K-8) and Best Management Practice K-4 associated with development near rivers, lakes and other specified habitats would be effective at minimizing impacts in high-value wetlands and other high-potential soils, such as areas dominated by pendant grass and riparian and floodplain habitats. Best Management Practice L-1 would minimize the impacts to soils of summer tundra travel, if such an action is permitted.

Under Alternative B-2, development would result in less impact to soil and plant communities than under Alternative A. The best management practices and lease stipulations associated with Alternative B-2 are quite similar to those of Alternative A, and would provide protection to limit impacts by minimizing destruction of soil profiles and alteration of plant communities.

4.5.3.4 Conclusion

Under Alternative B-2, the amount of soil area impacted from oil and gas exploration and development would potentially be less than those of Alternative A as fewer high-potential oil and gas areas would be available for leasing. Numerous technological advancements during the decades of operations on the North Slope have allowed current development activities to proceed with less environmental impact than previous operations (National Research Council 2003). However, some short-term disturbance and permanent long-term impacts to soils are inevitable. Impacts to soil resources from Alternative B-2 would potentially be somewhat lower than Alternative A, as fewer high-potential oil and gas areas would be available for leasing. See Table 4-14 in Volume 2 for a comparison of estimated total surface area disturbed by alternative. Loss of permafrost and soil insulation from activities associated with this alternative could be exacerbated by climate change as described in the conclusion of Alternative A.

Impacts to soil from management actions under Alternative B-2 would involve short-term disturbance over fairly large areas and long-term disturbance of relatively small areas. However, since impacts in Alternative B-2 cover less of the planning area than any other alternative (see Table 4-14 in Volume 2), the area of soil disturbance would be relatively small as a percentage of the entire planning area (see below). The duration of these impacts could range from one year or less, for minor disturbance of soil and vegetation, to decades, if the soil was destroyed or permafrost thawing was extensive.

Impacts to soils from activities other than oil and gas development under all alternatives would include minor impacts from aircraft landings, archaeological or paleontological excavations, camps, and overland moves. Recovery would vary from one year, for minor disturbance of soil and vegetation, to decades in those areas where soil was excavated or permafrost thawing was extensive.

Impacts to soils from oil and gas exploration under Alternative B-2 would occur from seismic work and construction of well cellars during exploratory drilling and the construction of ice roads and ice pads. The duration and recovery time for impacts associated with seismic work would be similar to those for overland moves and the same as for Alternative A. Based on earlier studies, there should be no substantial, long-term impacts to soils from seismic lines, but substantial impacts from camp move trails could remain on approximately 1,670 acres after 8 to 9 years. Effects of well cellar construction would also be permanent, but would impact only 0.2 acre of soil.

The effects of oil and gas development and operation would include destruction of soils during construction of gravel pads (central processing facilities and central gas facilities, satellite drill pads, pump and compressor stations, and staging bases), roads, and airstrips; from excavation of material sites and burial of gas pipelines; and construction of vertical support members. These impacts would be long-term and would impact about 8,402 acres, or 0.04 percent of the 22.8 million-acre NPR-A which is only slightly less than under Alternative A. Soil profiles could also be altered by dust deposition, salinity of gravel fill used in construction, snowdrifts, and blockage of or change to natural drainage patterns. These impacts would also be long-term and would impact about 21,581 acres, or 0.09 percent of the NPR-A (20 percent less than the amount of soil impacted under Alternative A).

It is assumed that impacts to soils and their vegetative communities would occur in proportion to their occurrence within the NPR-A. However, prohibiting development in a broad area around Teshekpuk Lake under Alternative B-2 could disproportionately conserve wetland soil classes compared to Alternative A. A higher percentage of wet soil groups occur in the area around the lake. Alternatively, precluding development in a large block in the south and west of the NPR-A would disproportionately conserve gravelly soils and their vegetative communities. This latter effect would be essentially the same, but larger under Alternative A.

Areal extent of short-term impacts under Alternative B-2 would be about 23 percent less than for Alternative A. Areal extent of long-term impacts under Alternative B-2 would be about 15 percent less than for Alternative A. Impacts to soils from non-oil and gas activities, and from oil and gas activities, would likely be additive, except in those areas where the two types of activities overlapped. Impacts to soils from exploration and development activities would also be additive, except where development activities occurred in areas previously disturbed during exploration. In areas where two or more activities occurred, overall impacts would reflect those impacts associated with the first activity and any new impacts associated with later activities.

4.5.4 Surface and Groundwater Resources and Water Quality

Alternative B-2 emphasizes the protection of surface resources, while making nearly 11.8 million acres of federally owned subsurface (52 percent of the total in NPR-A) available for oil and gas leasing. It would provide for a corridor to bring oil and gas from potential future offshore development in the Chukchi Sea to market via Umiat and to Alpine or Kuparuk. Section 2.3.2 describes this alternative in greater detail. This compares to Alternatives A, B-1, C, and D, which, respectively, offer 57, 48, 76, and 100 percent to leasing. Based on the potential for leasing, Alternative B-2 would have slightly more impacts to water resources and quality from exploration and development than Alternative B-1. Many of the required operating procedures in Alternative A are now referred to as best management practices in Alternatives B-1, B-2, C, and D, using the same numbering scheme with very similar language.

4.5.4.1 Activities Not Associated With Oil and Gas Exploration and Development

Under Alternative B-2, impacts to water resources and quality associated with non-oil and gas activities would essentially be the same as those described under Alternative A, section 4.3.4.1 in Volume 2.

4.5.4.2 Activities Associated With Oil and Gas Exploration and Development

Effect of Seismic Surveys

Modern-day seismic equipment has caused minimal impact to the tundra, but camp move vehicles can still cause thermokarst, especially when snow is insufficient to protect soil and vegetation (WesternGeco 2003). Removal or damage of the organic mat exposes soils to erosion by wind and water, which could deposit sediment into waterbodies resulting in higher turbidity and concentrations of suspended sediment. To cause high turbidity, the peat mat must be sufficiently eroded to expose underlying mineral soils, and the mineral soils must be fine grained. Best Management Practice C-2 requires ground operations to commence only when frost and snow are at sufficient depths to protect stream banks, and minimize the breakage, abrasion, compaction, or displacement of vegetation and prevent future thermokarst.

Studies of impacts to vegetation from seismic activity are discussed in section 4.3.5.2 of Volume 2. It is estimated that a total of 1,670 acres of moderate to high impacts from seismic activities could result from Alternatives B-1 and B-2, slightly more than Alternative A, and less than Alternatives C and D. These long-term impacts may result in thermokarst erosion with increased turbidity in local waterbodies.

Effects of Water Withdrawal from Lakes

The primary source of water during the winter months is unfrozen water that lies beneath the ice cover of both shallow and deep lakes. This water is somewhat saline because of the exclusion of ions during the freezing of the upper part of the lake. Water from lakes may be used for ice roads, pads and airstrips; and for drilling and production water and potable water at drilling facilities; but the volume of water taken from an individual lake depends on the depth of the lake, depth of unfrozen water in the lake, and the presence of fish and the type of fish present.

Alternative B-2, with slightly more leased land than Alternative B-1, will have more exploratory wells drilled; therefore, more water would be required for production, and more areas would be impacted. Best Management Practice B-2 insures water-permitting requirements are followed and are supplemented by water monitoring plans as needed to insure lakes are replenished. Effects during exploration on water quality from water withdrawals would be short term and minor, returning to normal levels after breakup. The provisions under Alternative B-2 are adequate to insure water quality and quantity is maintained after water withdrawals.

Effects of Ice Roads, Ice Pads, and Ice Bridges

Ice roads and ice pads are used extensively during the winter exploration season for access and for exploration drilling and testing. Best Management Practice C-3 requires river crossings to be made at low angles if at all possible, and remove, breach, or slot ice bridges before breakup. Ice roads may be required to be breached at stream crossings, especially if fish passage is a concern or the quantity of expected flow is significant during breakup. Under all of the alternatives, no long-term impacts are anticipated from ice roads, ice pads, or ice bridges.

Effects of Exploratory Drilling

Drilling operations require large amounts of water to create drilling fluid, which must be disposed of at the completion of drilling operations. Drilling fluid is typically a preparation of water, clay, and chemicals circulated into a well during drilling, and must be disposed of when operations cease. Best Management Practice A-2 requires all cuttings and drilling mud to be disposed of by injection, allowing on-pad temporary storage of muds and cuttings, as approved by Alaska Department of Environmental Conservation. Freshwater aquifers are protected by surface casing that is installed and cemented in place at varying depths, which are determined, by State natural gas and oil regulatory agencies. Lease Stipulation D-1 prohibits exploratory drilling in rivers and streams, as determined by the active floodplain and fish-bearing lakes unless there is no feasible or prudent alternative. These protective measures will decrease the risk of drilling muds or oil from blowouts from entering adjacent waterbodies.

Under Alternative B-2 up to 152 oil and gas exploration and delineation wells may be drilled. Under Alternatives A, B-1, C, and D, 196, 128, 244, and 256 wells, respectively, may be drilled. The number of rigs estimated under Alternative B-2 should result in fewer impacts from exploratory drilling than the other alternatives except for Alternative B-1. Exploratory drilling under Alternative B-2 is also not expected to have a measurable effect on water quality because spills will occur in the winter and will likely occur on ice pads.

Effects of Drainage Disruption by Gravel Roads, Pads, Runways, and Pipelines

Placement and construction of gravel pads, roadways, pipelines, bridges, runways, and culverts have the potential to divert, impede, or block flow in stream channels or shallow-water tracks, disrupting natural drainages. This disruption of streambeds and stream banks can remove protective shoreline vegetation and lead to channel erosion and sedimentation, formation of meltwater gullies, and formation of alluvial fans in streams and lakes (Lawson 1986).

Stream crossing structures can create scour channels and channel bars in streams and cause erosion from the pads or roads and transport gravel into streams and lakes. Blockages in areas with low flow capacity, especially culverts blocked by snow and ice, can result in seasonal and sometimes permanent impoundments (National Research Council 2003). The resulting inundation can affect tundra vegetation and possibly lead to thermokarst or creation of deeper, open waterbodies (Walker et al. 1987a, 1987b). Potential drainage pattern disruptions would be proportional to the acres of gravel and number of stream-crossing structures installed with each alternative.

Pipeline construction within the NPR-A would depend on the location and sequence of commercial-size discoveries. Narrow streams could be crossed using elevated pipelines on suspension spans. Wider, shallow rivers could be crossed by trenching and burying insulated pipelines in the riverbed. All entrenched crossings would be constructed in the winter at locations selected to minimize disturbances to tundra. All pipelines would be routed to avoid lakes.

Once installed, suspended and entrenched pipelines would have no effect on stream and water flow characteristics. Buried pipelines, which are less commonly used on the North Slope, could have potential thermokarst, subsidence, and possible exposure by stream erosion beyond the construction phase.

Impacts from drainage disruptions will be mitigated by Lease Stipulation E-2 which prohibits permanent oil and gas facilities within specified distances from waterbodies, Best Management Practice E-6 that requires that stream and marsh crossings be designed and constructed to ensure free passage of fish, reduce erosion, maintain natural drainage, and minimize adverse effects to natural stream flow and Lease stipulations K-1 (Rivers) and K-2 (Deep Water Lakes) which require setbacks from rivers and lakes for permanent oil and gas facilities to minimize the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of deep water lakes.

Because more or less infrastructure is estimated to occur in different alternatives, the potential for some shortcoming in design of infrastructure to result in impacts will vary with that variation among the alternatives. The stipulations and design requirements described above should provide adequate protection to ensure natural flow characteristics and water quality is maintained.

Under Alternative B-2 the BLM estimates 5,614 acres of gravel placement for production pads, in-field roads, and runways. This compares to Alternatives A, B-1, C, and D with 7,074, 5,037, 9,387, and 10,438 acres, respectively. Alternative B-2, with slightly more lease area than Alternative B-1, would have less disruption of drainages, erosion, and sedimentation than under the other alternatives. However, if the lease stipulations and best management practices listed for this alternative are followed, impacts should be minor.

Effects of Gravel Pits

Removal of gravel from areas near streams and lakes can result in changes to stream or lake configurations, stream-flow hydraulics, lake shoreline flow patterns, erosion, sedimentation, and ice damming (National Research Council 2003). Locating gravel pits at an adequate distance from streams and lakes would minimize these impacts. Alternative sources of gravel for future development might include importing gravel from borrow sites east of the Colville River, extracting gravel from existing sites, processing bedrock, or using sand/silt/foam composites.

Gravel mining in the coastal plain would create some localized sedimentation and new or enlarged waterbodies, particularly if gravel was extracted from within floodplains. Gravel extraction outside the floodplain, especially within the foothills, would be less likely to create new lakes, but could produce sedimentation. Best Management Practice E-8 would locate gravel mine sites outside active floodplains whenever possible.

Alternative B-2, since it would remove a large part of the coastal plain from leasing and development, would likely result in fewer new lakes from gravel mining than the other alternatives. Under Alternative B-2, up to 31 gravel pits (1,125 acres) could be required for the development scenarios presented in Table 4-14 in Volume 2. This compares to 40 (1,415 acres), 29 (1,007 acres), 52 (1,941 acres), and 55 (2,088 acres) gravel pits, respectively, for Alternatives A, B-1, C, and D.

Effects from Waterflooding

Waterflooding is a process of injecting water into underground reservoir rock to maintain reservoir pressure and maximize recoverable oil reserves. Alaska Oil and Gas Conservation Commission oversees the Underground Injection Control Program to ensure underground sources of drinking water are protected. Under Alternative B-2 an estimated 476 oil production and service wells and 229 gas production and water disposal wells could be drilled, less than all of the alternatives except Alternative B-1. Therefore, spills or groundwater contamination impacts from waterflooding will be less likely to occur under Alternative B-2 than under other alternatives except for Alternative B-1. Impacts to groundwater resources or from spills transporting seawater to wells for waterflooding are expected to be minimal.

Effects of Oil Spills and Gas Releases

Under Alternative B-2, the types of impacts to water resources and quality associated with oil spills and gas releases would essentially be the same as those described under Alternative A, section 4.3.4.2 in Volume 2.

There are a number of stipulations and best management practices that would help reduce the risk of fuel-related spills. Best Management Practice A-3 requires a Hazardous Materials Emergency Contingency Plan before transportation, storage, or use of fuel or hazardous substances contingency plans require industry to provide refresher spill-response training, and plan and conduct a major spill-response drill annually. Best Management Practice A-4 mandates that lessees are required to develop a comprehensive spill prevention and response contingency plan, which will have sufficient on-site oil-spill-cleanup materials and proper storage containers.

Best Management Practice A-5 places restrictions on refueling or storage of equipment within the active flood plain of any water body. Lease Stipulation E-2 prohibits permanent oil and gas facilities, including roads, airstrips, and pipelines, within 500 feet of the ordinary high water mark. Essential pipeline and road crossings will be permitted on a case-by-case basis and construction camps are prohibited on frozen lakes and river ice. Best Management Practice E-4 requires all pipelines to be designed, constructed, and operated under an authorized officer-approved quality assurance/quality control plan specific to the product transported.

Under Alternative B-2 the BLM estimates there could be 399 small spills of refined and crude oil less than 500 barrels in size. This compares to estimates of 525, 367, 514, and 553 spills, respectively, from Alternatives A, B-1, C, and D. Alternative B-2 predicts a 30 percent chance of one or more large oil spills greater than 500 barrels and a 44 percent chance of one or more large spills greater than 500 barrels of produced water or seawater, which are the greatest potential for spills than all other alternatives except for Alternative B-1.

Effects of Abandonment and Reclamation

Removal of facilities, particularly roads, bridges, and culverts, would likely cause increased sedimentation and erosion immediately after removal. However, natural drainage will be reestablished within several years to more than a decade depending upon the facilities removed and the local hydrology and terrain. Leaving pads, airstrips, roads, bridges, and culverts in place, particularly without future maintenance, however, would result in longer-term, higher levels of erosion, sedimentation, and upslope impoundment. Ponds would be formed from melting of ice wedges or other ice underlying the gravel facilities. Leaving the roads in place, but removing bridges and culverts and breaching the roads where culverts had been placed, would reduce upslope impoundment. Because under Alternative B-2 more gravel infrastructure would be created than in Alternative B-1 but less than, under Alternatives A, C, and D, Alternative B-2 could result in less sedimentation, erosion, and water impoundment than all alternatives except B-1 due to the reduced amounts of infrastructure.

4.5.4.3 Effectiveness of Stipulations and Best Management Practices

The lease stipulations and best management practices protective of water resources and water quality have been discussed in the above sections of Alternative B-2. A complete listing of these stipulations and best management practices are also listed in Alternative B-1, section 4.4.4.3 of Volume 2.

4.5.4.4 Conclusion

The potential impacts to water resources and quality from oil exploration and development activities under Alternative B-2 include the following: turbidity changes of waterbodies due to thermokarst from seismic and overland travel activities and from dust effects adjacent to roads and pads; losses of water and possible water quality changes from water withdrawals; erosion and sedimentation associated with road and pad building; inadequately designed river crossing structures; impounded water at road crossings; alteration of drainages from pipelines, pads, ice and gravel roadways, airstrips, and gravel mines; and impacts on water quality from oil, produced water and seawater spills into waterbodies.

Global climate change could have unpredictable impacts on winter temperatures, water balance and availability of water, timing and magnitude of spring floods, rising sea level, storm surges, and coastal erosion. A shortened winter season and warmer soil temperatures could increase the potential to damage vegetation from seismic surveys and overland travel and result in thermokarst. A longer growing season could result in increased potential evapotranspiration reducing available water in lakes. Premature melting of ice roads could occur with sudden spring melts, requiring emergency demobilization of drilling operations in order to protect the tundra. Increased snowfall combined with late summer rainfall could increase the magnitude of spring peak flows above the normal range of flows. Greater expanses of open water on the Beaufort and Chukchi seas could increase the potential for storm surges to cause accelerating rates of coastal erosion and flooding of inland lakes and ponds. All alternatives under consideration would be affected, although fewer impacts under Alternatives B-1 and B-2 would occur due to less development in the Teshekpuk Lake area.

Adherence to federal and State operational guidelines, best management and safety practices, planning requirements, lease stipulations and BMPs will all serve to reduce impacts from these activities. Some localized, but temporary effects to water resources or quality may occur from most activities described in Alternative B-2. The exception would be the case for permanent gravel pads and stream crossing structures and very large spills, which would have long-term impacts described in the above sections.

In general, impacts between alternatives are proportional to acres available to leasing and projected future production. Alternative B-2 would be expected to have fewer impacts to water resources and quality than all other alternatives except for Alternative B-1.

4.5.5 Vegetation

4.5.5.1 Activities Not Associated with Oil and Gas Exploration and Development

Under Alternative B-2, impacts to vegetation associated with non-oil and gas activities would essentially be the same as those described under Alternative A.

4.5.5.2 Oil and Gas Exploration and Development Activities

Various activities associated with oil and gas exploration, development, and production could impact vegetation in the NPR-A. These activities include seismic operations, exploration drilling, gravel road, pad, and airstrip construction, pipeline construction, and construction of ice roads and ice pads.

Exploration

Under Alternative B-2, types of impacts to vegetation from activities associated with oil and gas exploration would be similar to those that occur under Alternative A, except that there would be fewer exploration and delineation wells drilled, which would decrease the impacts of well collar construction and the number and impacts of both ice pads and ice roads.

Under Alternative B-2, the same scenario for seismic exploration is assumed as for Alternative A in terms of number and types of surveys, the area covered is slightly larger for the 3-D surveys. Short-term vegetation disturbance from 2-D and 3-D operations combined would total a maximum of 581,397 acres (2.5 percent of the 22.8-million-acre NPR-A). Long-term disturbance is estimated to total 1,670 acres.

During the life of the plan, it is assumed that 76 exploration wells and the same number of delineation wells, or a total of 152 wells for both oil and gas, would be drilled from ice pads in the NPR-A under Alternative B-2. At 6 acres per pad, these would impact 912 acres of tundra, spread out over 30 years (a reduction of 22 percent compared to Alternative A).

Under Alternative B-2, ice road and snow trail construction would also be less than in Alternative A in terms of total miles. The total acreage of short-term disturbance from ice roads and snow trails over 30 years would be 249,246 acres, about 23 percent less than for Alternative A. Since vegetation recovery from ice road impacts is expected within a few years (Yokel et al. 2007), long-term disturbance from ice roads would be negligible.

Although some evidence of crushed tussocks may still be apparent, new growth would preclude any exposed soils.

Ice airstrips are also used during exploratory drilling, and under Alternative B-2, it is assumed that 65 ice airstrips would be constructed, covering 11 acres each for a total of 715 acres (35 percent less than under Alternative A). These airstrips are commonly built on the grounded ice of large lakes, but if they were built over tundra they would result in impacts similar to ice roads.

The construction of well cellars during exploration requires digging a hole that destroys vegetation on approximately 64 square feet (0.0015 acre) of ground. Thermokarst associated with the disruption of thermal regime in the surrounding soil may also change the vegetation type around the well cellar to a wetter vegetation type. These impacts could result in 0.2 acres of vegetation being destroyed under Alternative B-2 (33 percent less than under Alternative A).

Development

During oil and gas development and production, various activities could cause impacts to vegetation in the NPR-A. These activities include construction and use of gravel pads, roads, airstrips, and pipelines, excavation of material sites, and construction of ice roads and ice pads. Ice roads and pads are covered above.

Placement of Gravel Fill

Construction of central processing facilities or gas compressor facilities and associated satellite pads, roads, staging areas, and airstrips would result in the destruction of vegetation in the areas of gravel placement. Under this alternative, eight central processing facilities and 21 gas compressor facilities with associated satellite pads, roads and airstrips, two pump stations and three staging bases would be developed, resulting in 5,336 acres of vegetation being destroyed by gravel placement (29 percent less than under Alternative A).

The decreased facilities construction and use under Alternative B-2 would result in a smaller area impacted by dust than under Alternative A. Assuming a total of 566 miles of in-field gravel roads and 27.5 miles of airstrips, there is a potential for a total perimeter of 1,187 miles. Within 30 feet of gravel fill, up to 4,316 acres of vegetation could be subject to smothering by dust and gravel, and another 17,265 acres could be affected by a dust shadow that affects out to 150 feet.

Construction of gravel pads, roads, and airstrips could alter the moisture regime of tundra near the structure by changing natural drainage patterns and areas where snow accumulates. Snowdrifts caused by gravel structures increase the wintertime soil surface temperature and increase thaw depth in soils near the structures. These impacts are exacerbated by dust deposition (described above) and by the formation of impoundments (described below). These factors could combine to warm the soil, deepen thaw, and produce thermokarst adjacent to roads and other gravel structures (NRC 2003). Additionally, these changes could alter the species composition of the plant community near gravel structures. In general, most changes in the plant community around gravel structures would occur within 164 feet of the structure. If all effects were to occur within this zone, a maximum of 23,596 acres would be impacted under Alternative B-2 (19 percent less than under Alternative A). Note that this area includes the 21,581 acres affected by dust above, and is not in addition to it.

The construction of gravel roads into and within the NPR-A would provide a mechanism for the spread of non-native, invasive plants into the NPR-A. The effects of dust and gravel spray from the roads may also provide a substrate suitable for colonization of non-native, invasive plants. Oil and gas development in the NPR-A may cause, or accelerate, the invasion of the NPR-A by non-native, invasive plants. The potential for colonization by non-native, invasive plants could be reduced by pressure washing all equipment and vehicles before moving them into the NPR-A. This could effectively remove any seeds that wedge in cracks or crevices, or adhere to equipment or vehicles. Removing dirt from vehicles could also prevent potentially dangerous soil-borne pathogens or contaminants from being introduced to the NPR-A.

Material Sites

Gravel required for development in the NPR-A could be mined from existing sites east of the NPR-A, or could be extracted from new sites developed within the NPR-A. Investigations to identify gravel sources in the NPR-A have not been conducted, for undiscovered oil and gas, although the Clover Mine Site west of Nuiqsut was identified for discovered oil during exploratory drilling and was subsequently further assessed. Additional surveys for gravel resources will presumably be initiated if further discoveries of recoverable oil and gas are made. Under Alternative B-2, it is assumed that up to 31material sites would be needed, covering a total area of 1,125 acres (20 percent less than under Alternative A). Excavation of the gravel mine and stockpiling of overburden would destroy vegetation at these sites.

Pipelines

Under Alternative B-2, types of impacts from oil and gas pipeline construction would be similar to those described for Alternative A. The total area disturbed by each vertical support member for oil pipelines would be about 15 square feet. About 6 percent of this area would be vegetation destroyed and replaced by the vertical support member, and the remaining portion would be potentially altered in terms of community type or species composition. Approximately 0.05 acre of vegetation would be disturbed per pipeline mile for oil-gathering pipelines, and 0.03 acre per mile of regional oil pipelines. Under Alternative B-2, 154 miles of gathering lines for oil, and 451 miles of regional oil pipelines would disturb about 20 acres of vegetation through vertical support member placement, or about 26 percent less than under Alternative A. Ice roads built for constructing these pipelines would have short-term impacts to vegetation on less than 2,565 acres. In reality, some of the vertical support members for gathering lines would be over gravel pads and would have no impacts on vegetation, nor would ice roads be necessary for constructing these portions of pipeline. It is assumed that gas pipelines would be buried, so impacts to vegetation would be different than for oil pipelines. In the case of buried gathering, regional, and high-pressure gas pipelines, short-term disturbance from ice roads would affect 3,805 acres. Long-term impacts from trenching and spoils storage would occur on 1,631 acres.

Summer Tundra Travel

On a case-by-case basis, the BLM may permit low-ground-pressure vehicles to travel off gravel pads and roads during periods other than when the ground is frozen and covered with snow. This is expected to be an uncommon occurrence, and if permitted at all it would likely be only during early summer or late summer to fall. Because of restrictions that would be placed on this activity, impacts to vegetation should be limited to the compression of standing vegetation, similar to what happens during winter following traffic by low-ground-pressure vehicles.

Air Pollution

The potential for impacts to vegetation from air pollution would be less under Alternative B-2, given the smaller scenario for additional oil and gas fields and processing and compressor facilities, as compared to Alternative A. However, it is unlikely that there would be substantial impacts to vegetation from pollutants in the NPR-A under either alternative.

Abandonment and Reclamation

During abandonment activities, vegetation and wetlands would be impacted by dust fallout along roads, by ice roads and other off-road tundra travel associated with dismantling of pipelines and power lines, and by disturbance to vegetation adjacent to vertical support members and power line poles during their removal. The level of impact from these activities would be roughly the same as that during construction if gravel fill was removed; impacts would be less if the gravel were left in place. If roads and pads were left in place, and especially if cross drainage across roads was not maintained, water impoundment would occur, and could alter plant communities as described for the construction period. It is also likely that the unmaintained roads would have occasional washouts, where tundra vegetation would be covered with washed-out gravel. Roads and pads, if left in place, would likely need to be revegetated with plants native to gravel bars and ridges in the Arctic (i.e., different from the plant communities surrounding the facilities). Revegetation activities could take several years, as initial attempts are not always successful. Removal of gravel from pads, roads, and airstrips could be mandated. Partial or complete removal of gravel can result in faster reestablishment of native plant growth, although establishment can take many years (more than a decade). In addition, thaw subsidence is difficult to predict, and complete restoration to preexisting conditions is not likely.

Effects of Spills and Gas Releases

The reduced amount of leasing, development, and production of oil and gas that would occur under Alternative B-2, relative to Alternative A, would result in a smaller number of small spills of crude and refined oil, produced water, and seawater in the NPR-A, but a larger number of gas releases due to the increased miles of regional gas pipelines assumed. The probability of a large oil spill occurring would also be less under Alternative B-2; but for analysis, the assumption remains at one large spill.

Most oil spills cover less than 500 square feet (less than 0.01 acre), although a pressured aerial mist may cover up to 145 acres (Ott 1997). (Such a spill is a very low probability event, occurring less than once out of the total spills expected throughout the life of this plan. Thus, its magnitude is not apparent in the following acreages.) If 11 percent of all oil spills would reach vegetation during summer, under Alternative B-2 this would mean 44 of the 399 crude and refined oil spills assumed to occur over the life of the plan would have more than a negligible effect on vegetation. Assuming the average spill would cover 0.1 acre, under Alternative B-2 approximately 4 acres would be impacted substantially during the lifetime of development in the NPR-A. This is about 24 percent less than the acreage impacted under Alternative A. Overall, past spills on Alaska's North Slope have resulted in minor ecological damage, and ecosystems have shown good potential for recovery (Jorgenson 1997). There are techniques that may accelerate the cleanup process after an oil spill (e.g., Yakubu et al. 2009).

A single gas release occurring with ignition could have thermal effects to approximately 194 acres of tundra vegetation (500-meter radius). The assumed number of gas releases under Alternative B-2 (2.7 = 0.9 incidents per 300 pipe miles times 897 miles of pipe), if ignited, would result in thermal effects to approximately 524 acres of tundra. If a wildfire resulted, additional acreage would burn, the amount depending on season, weather conditions, moisture content of vegetation, and suppression effort. Most North Slope tundra fires are less than 1,000 acres (Racine and Jandt 2008). Total vascular plant cover following lightning-caused tundra fires reached 50–100 percent after 5 to 6 years (Racine et al. 1987). Lichens, however, could take several decades to recover, if they can achieve former densities at all under a climate-warming regime (Jandt et al. 2008).

4.5.5.3 Effectiveness of Stipulations and Best Management Practices

Many of the lease stipulations and best management practices associated with Alternative B-2 would directly or indirectly limit potential impacts to vegetation in the NPR-A. Best Management Practices A-1 through A-7 relate to waste prevention, handling, disposal, spills, and public safety. They ensure that waste materials associated with exploration and development activities would be properly disposed of and would effectively minimize impacts to vegetation from spills and mishandling of materials. They would also provide for rapid cleanup of spills, decreasing the likelihood of impacts to vegetation. Best Management Practices A-9 and A-10 would reduce air pollution. Best Management Practice C-2 on overland moves and seismic work would also effectively minimize impacts to vegetation.

Lease Stipulation D-1 would effectively protect riparian habitat by preventing exploratory drilling in rivers, streams, and active floodplains. Lease Stipulation D-2 would effectively minimize surface impacts from exploratory drilling by limiting activities to temporary structures such as ice pads, ice roads, ice airstrips, and temporary platforms unless permanent structures were absolutely required. Lease Stipulation E-2 and Best Management Practices E-4, E-5, E-6, E-8, and E-12 would effectively minimize impacts to vegetation by providing facility design and construction regulations that would limit the footprint of developments, provide protection from oil spills, provide setbacks that protect riparian and other high-value habitats, and ensure that habitat and resource issues were considered in the placement of facilities. Lease Stipulation G-1 would facilitate the regrowth of native vegetation following facility abandonment. The setbacks outlined in lease stipulations (K-1, K-2, K-3, K-7, and K-8) and Best Management Practice K-4 associated with development near rivers, lakes, and other specified habitats would be effective at minimizing impacts in high-value wetlands, such as areas dominated by pendant grass and riparian and floodplain habitats. Best Management Practice M-2 would help prevent the introduction, or spread, of non-native, invasive plant species in the NPR-A. Best Management Practice L-1 would minimize the impacts to vegetation of summer tundra travel, if such an action is permitted.

Under Alternative B-2, development would result in fewer impacts to vegetation and plant communities than under the other alternatives. The best management practices and lease stipulations associated with Alternative B-2 are quite similar to those of Alternative A and would provide protections to limit impacts by minimizing destruction of vegetation and alteration of plant communities.

4.5.5.4 Conclusion

Under Alternative B-2, impacts to vegetation from activities other than oil and gas development would be essentially the same as those under Alternative A, and would include minor impacts from aircraft landings, archaeological or paleontological excavations, camps, and overland moves. The duration of the actions causing these impacts would be short-term, ranging up to five months, and recovery would vary from one to several years. Some impacts from snow machines and ATVs, where the same trail is followed continuously such as near villages, could be major (but localized) and would not recover as long as the traffic continues.

As for Alternative A, impacts to vegetation from oil and gas exploration under Alternative B-2 would occur from seismic work and construction of well cellars during exploratory drilling and the construction of ice roads and ice pads. The duration and recovery time for impacts associated with seismic work would be similar to those for overland moves and the same as for Alternative A. Based on earlier studies, there should be no substantial, long-term impacts to vegetation from seismic lines, but substantial impacts from camp move trails could remain on approximately 1,670 acres after 8 to 9 years. Effects of well cellar construction would also be permanent, but would impact only 0.2 acre of vegetation.

The effects of oil and gas development and operation would include destruction of vegetation during construction of gravel pads (central processing facilities and gas compressor facilities, satellite drill pads, pump stations, and staging bases), roads and airstrips; from excavation of material sites and burial of gas pipelines; construction of vertical support members; and the potential for colonization by non-native, invasive species. These impacts would be long-term and would impact about 8,402 acres, or 0.04 percent of the 22.8-million-acre NPR-A (slightly less than under Alternative A). Plant communities could also be altered by dust deposition, salinity of gravel fill used in construction, snowdrifts, and blockage of or change to natural drainage patterns. These impacts would also be long-term and would impact about 23,596 acres, or 0.1 percent of the NPR-A (19 percent less than the amount of vegetation impacted under Alternative A).

It is assumed that impacts to vegetation types or communities would occur in proportion to their occurrence within the NPR-A. However, prohibiting development in a broad area around Teshekpuk Lake under Alternative B-2 could disproportionately conserve wetland vegetation classes compared to Alternative A. A higher percentage of wet vegetation communities occur in that area around the lake. Alternatively, precluding development in a large block in the south and west of NPR-A would disproportionately conserve dwarf shrub, tussock tundra, and sparsely vegetated communities. This latter effect would be essentially the same but larger under Alternative A.

Areal extent of short-term impacts under Alternative B-2 would be about 23 percent less than for Alternative A. Areal extent of long-term-term impacts under Alternative B-2 would be about 18 percent less than for Alternative A. Impacts to vegetation from non-oil and gas activities, and from oil and gas activities, would likely be additive, as opposed to compensatory, except in those areas where the two types of activities overlapped. Impacts to vegetation from exploration and development activities would also be additive, except where development activities occurred in areas previously disturbed during exploration. In areas where two or more activities occurred, overall impacts would reflect those impacts associated with the first activity and any new impacts associated with later activities. As for Alternative A, recovery of tundra vegetation to its original composition from any of the above impacts may be delayed or precluded entirely as a result of simultaneous effects of climate change, i.e., increased shrub height and cover extent, decreased lichen and moss cover, increased thermokarst, and increased inundation of coastal areas by salt water. Such impacts of climate change could accumulate with any changes in soil thermal regimes that might occur as a result of past and future non-oil and gas and oil and gas activities in and near the NPR-A, potentially leading to synergistic impacts to vegetation.

4.5.6 Wetlands and Floodplains

4.5.6.1 Activities Not Associated with Oil and Gas Exploration and Development

Under Alternative B-2, impacts to wetlands and floodplains associated with non-oil and gas activities would essentially be the same as those described under Alternative A.

4.5.6.2 Oil and Gas Exploration and Development Activities

Various activities associated with oil and gas exploration, development and production could impact wetlands and floodplains in the NPR-A. These activities include overland moves, seismic operations, exploration drilling, construction of ice roads and ice pads, summer tundra travel, gravel roads, gravel pads for pump stations, central processing facilities, gas compressor facilities, and staging bases, airstrips, pipeline construction, and gravel mine sites.

Exploration

Under Alternative B-2, types of impacts to wetlands and floodplains from activities associated with oil and gas exploration would be similar to those that occur under Alternative A. The same scenario for seismic exploration is assumed as for Alternative A, in terms of number and types of surveys, although the area covered is slightly larger in Alternative B-2 for the 3-D surveys. Short-term vegetation disturbance from all seismic operations combined would total a maximum of 581,397 acres. Long-term disturbance is estimated to total 1,670 acres.

The reduced expectation for exploration and fewer delineation wells under Alternative B-2 compared to Alternative A would decrease the impacts of well cellar construction and the number and impacts of ice roads, pads, and airstrips. Under Alternative B-2, 249,246 acres of short-term disturbance may occur from ice roads, snow-packed trails, ice airstrips, and ice pads for wells. Since recovery of vegetation from these impacts is expected within a few years (Yokel, et al. 2007), long-term disturbance from ice pads, ice roads, ice airstrips, and snow trails would be negligible.

The construction of well cellars during exploration requires the digging of a hole that destroys vegetation on approximately 64 square feet of ground, replacing that vegetation with bare soils. Alternative B-2 will impact up to 0.2 acre, 50 percent less than under Alternative A.

Development and Production

During oil development and production, various activities could cause impacts to wetlands and floodplains in the NPR-A. These activities include construction of gravel pads for pump stations, staging bases and central processing facilities, roads, airstrips, pipelines, excavation of material sites, summer tundra travel, and construction of ice roads. Impacts of ice roads were discussed in Alternative A.

Construction of central processing facilities and gas compressor facilities, and associated satellite pads, roads, and airstrips, would result in the destruction of vegetation in areas where gravel was placed. All gravel placement taken together would total 5,336 acres, 29 percent less than Alternative A.

Blockage of natural drainage patterns can lead to the formation of impoundments, which could alter both the hydrology and species composition of wetlands. Plant productivity could increase, favoring a few species or decrease due to the development of deeper, open water areas. The use of adequate cross drainage structures in gravel roads and attention to the natural drainage patterns during design of developments could help reduce impacts to wetlands from impoundments.

The decrease in facilities construction and use under Alternative B-2 would result in a smaller area impacted by dust than under Alternative A. Impacts to plant communities around gravel structures would occur within 164 feet of the structure (Woodward-Clyde Consultants 1983). If all effects were to occur within this zone, a maximum of 23,596 acres would be impacted under Alternative B-2.

Gravel pit excavation and stockpiling of overburden would destroy wetlands at gravel extraction sites. Locating gravel pits an adequate distance from streams and lakes would minimize these impacts, however, most gravel sources are in riverbeds and floodplains. It is possible to design gravel pits to enhance fish habitat at the end of the mining operations if they are located in the floodplain. Under Alternative B-2, up to 31 material sites covering 1,125 acres would be required (20 percent less than under Alternative A).

Under Alternative B-2, types of impacts from oil and gas pipeline construction would be similar to those described for Alternative A. A detailed discussion of impacts from pipelines to vegetation is in section 4.3.5.2 of Volume 2. A zone of disturbance around the pipeline vertical support members may result in vegetation changes around the vertical support members. Alternative B-2 could disturb up to 20 acres of vegetation through vertical support member placement. Ice roads built for construction of these pipelines would have only short-term impacts to vegetation, as described above for exploration activities, and would affect 2,565 acres. It is assumed that gas pipelines would be buried, so impacts to vegetation would be different than for oil pipelines. This short-term disturbance for gas-gathering lines, regional, and high-pressure gas pipelines would affect 5,437 acres. Total long-term impacts from burial of these pipelines would be 1,631 acres.

Low-ground-pressure vehicles may be permitted to travel off of gravel pads and roads during periods other than when the ground is frozen and covered with snow. This activity is commonly associated with pipeline inspections and spill-prevention and preparedness measures required in spill-prevention plans during the summer. Impacts under Alternative B-2 would be similar to those described in Alternative A and result in negligible short- and long-term impacts.

Abandonment and Reclamation

Under Alternative B-2, the types of impacts to wetlands and floodplains associated with abandonment and reclamation of gravel roads and pads, pipelines, and other facilities would essentially be the same as those described under Alternative A. Approximately 7,277 acres of gravel fill could be rehabilitated under Alternative B-2, a 14 percent reduction from Alternative A.

Effects of Spills and Gas Releases

Under Alternative B-2, impacts to wetlands and floodplains associated with spills and gas releases would essentially be the same as those described under Alternative A. The reduced amount of leasing, development, and production of oil and gas that would occur under Alternative B-2, relative to Alternative A, would result in a smaller number of small spills of crude and refined oil, produced water and seawater in the NPR-A, but a larger number of gas releases due to the increased miles of regional gas pipelines assumed. The probability of a large oil spill occurrence would also be less under Alternative B-2; but for analysis purposes, it is assumed that only one large spill would occur.

An estimated 11 percent of all spills would occur in the summer and leave gravel pads. This would result in 40 small spills over the life of the plan in Alternative B-2. Assuming an average spill would cover 0.1 acre, an estimated 4 acres could be impacted over the period of development in Alternative B-2, 30 percent less than Alternative A.

A single gas release occurring with ignition could have thermal effects to approximately 194 acres of tundra vegetation. The assumed number of gas releases under Alternative B-2 would result in thermal effects to approximately 504 acres of tundra.

Effectiveness of Stipulations and Best Management Practices

The lease stipulations and best management practices described in Table 2–3 (Volume 1) should effectively reduce the development impacts on wetlands and floodplains under Alternative B-2. Best Management Practices A-1 through A-7 would address solid and liquid-waste disposal, fuel handling, and spill cleanup would be expected to reduce the potential effects of releases, spills, and solid waste on wetlands and floodplains. Best Management Practice C-2, which addresses overland moves and seismic work, would also effectively minimize impacts to wetlands and floodplains by requiring sufficient depths of frost and snow to protect vegetation. Offsets may be required to avoid using the same route or track in the subsequent year. These requirements will protect streambanks, minimize compaction of soils, and minimize the breakage, abrasion, compaction, or displacement of vegetation.

Application of Lease Stipulations D-1 and D-2, which address activities associated with oil and gas exploration, prohibit drilling in streams and construction of permanent structures during exploratory drilling, and Best Management Practices E-4, E-5, E-6, and E-12, which address design and construction of pipelines, roads, drill pads, airstrips, and other facilities, are expected to effectively minimize the amount of habitat that would be altered by gravel pads and other surface disturbances. Best Management Practice E-8 encourages placement of gravel mine sites outside the active floodplain with conversion to water reservoirs when located within floodplains. Lease Stipulation G-1 would facilitate the regrowth of native vegetation following facility abandonment. The setbacks outlined in lease stipulations (K-1, K-2, K-3, K-4, K-7, K-8, and K-11), which address development near rivers, lakes, and other similar aquatic habitats would be effective at minimizing impacts in high-value wetlands, such as areas dominated by riparian and floodplain habitats. Best Management Practice L-1 would minimize the impacts to wetlands and floodplain of summer tundra travel, if such an action is permitted.

Under Alternative B-2, development would result in fewer impacts to wetlands and floodplains than under Alternative A. The best management practices and lease stipulations associated with Alternative B-2 are quite similar to those of Alternative A, and would provide protections to limit impacts by minimizing destruction of vegetation and alteration of plant communities and floodplain habitat.

Conclusion

Under Alternative B-2, impacts to wetlands and floodplains from activities other than oil and gas would essentially be the same as those described under Alternative A.

Impacts to wetlands and floodplains from oil and gas exploration would occur from seismic work, construction of ice roads and ice pads, and construction of well cellars during exploratory drilling. The duration and recovery time for impacts associated with seismic work would be similar to those for overland moves. Based on earlier studies, there should be no substantial, long-term impacts to wetlands and floodplains from seismic lines, but camp move trails could substantially impact approximately 1,670 acres after 8 to 9 years. Effects of well cellar construction would also be long-term, but would impact less than 0.4 acre of vegetation.

The effects of oil and gas development and operation would include destruction of wetlands during construction of gravel pads (central processing facilities or gas compressor facilities, satellite drill pads, pump stations, and staging bases), roads, and airstrips, from excavation of material sites and burial of gas pipelines, and construction of vertical support members. These impacts would be long-term and would impact about 8,402 acres of the NPR-A. Plant communities could also be altered by dust deposition, salinity of gravel fill used in construction, snowdrifts, and blockage of or change to natural drainage patterns. These impacts would be also be long-term and would impact about 23,596 acres. Spills of oil, other chemicals, and saltwater could occur, and would have long-term impacts; except for those associated with small-size spills, which would be cleaned up immediately, allowing recovery within a few years to two decades.

The potential for many shallow streams, ponds, and wetlands in the Arctic to dry out under a warming climate is increased by the loss of permafrost. These shallow systems depend on snowmelt as their primary source of water, with rainfall gains often negated by evapotranspiration during the summer. Evaporation from these shallow waterbodies is very likely to increase as the ice-free season lengthens. Hence, the water budget of most lake, pond, and wetland systems is likely to depend more heavily on the supply of spring meltwater from winter precipitation to produce a positive annual water balance, and these systems are more likely to dry out during the summer (ACIA 2004).

Climate change could alter species composition, increasing the prevalence of deciduous shrubs and decreasing the prevalence of wetland sedges and grasses, and could greatly influence wetlands through hydrological changes. Warmer soil temperatures are likely to increase thermokarst and increases in sea level may inundate low-lying tundra areas increasing aquatic and wet tundra vegetation types and increase erosion of coastal bluffs (ACIA 2004). Such impacts of climate change could accelerate or exacerbate changes in soil thermal regimes that occur with oil and gas development, potentially leading to greater and/or cumulative impacts (Walker et al. 1987) to wetlands from changes associated with thermokarst.

Areal extent of short-term impacts under Alternative B-2 would be about 23 percent less than for Alternative A. Areal extent of long-term-term impacts under Alternative B-2 would be about 18 percent less than for Alternative A.

4.5.7 Fish

4.5.7.1 Activities Not Associated with Oil and Gas Exploration and Development

The potential types of effects on fish from non-oil and gas activities under Alternative B-2 would be the same as those described for Alternative A in section 4.3.7.1 of Volume 2; the frequency and intensity of those activities would be expected to be similar.

4.5.7.2 Oil and Gas Exploration and Development Activities

The following discussion addresses the potential effects of oil and gas activities on freshwater, anadromous, and marine fish and fish habitat found within the NPR-A under Alternative B-2.

Effects of Seismic Surveys

The potential types of effects on fish from seismic surveys under Alternative B-2 would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2. Additionally, BMP C-5, which is only included in Alternative B-2, provides further protection to fish from high-intensity acoustic noise associated with seismic surveys.

Under Alternative B-2, effects of seismic surveys on freshwater, anadromous, or marine fish should be localized and primarily impact individual fish in a specific lake or other overwintering location. It can be assumed that the more miles that are surveyed under any given alternative, the greater the probability that effects on fish may occur. The incidence of impacts on fish occurring from seismic surveys under Alternative B-2 (58,338 surveying miles) would be 8 percent more than Alternative A, the same as Alternative B-1, 18 percent less than Alternative C, and 25 percent less than Alternative D.

Effects of Snow Trails, Ice Roads, Ice Pads, and Ice Airstrips

The potential types of effects on fish from snow trails, ice roads, ice pads, and ice airstrips under Alternative B-2 would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2.

Under Alternative B-2, effects on freshwater, anadromous, and marine fish from snow trails, ice roads, ice pads, and ice airstrips, and the associated activities that take place on this temporary infrastructure, such as vehicle travel, industrial equipment transport and use, exploratory drilling, and supporting work camps, would likely be localized to a number of discrete locations. Across different alternatives, the anticipated length of ice roads and snow trails is a reasonable relative index of potential effects on fish from winter oil and gas activities. The greater the transportation network, the more supporting infrastructure and associated activities. From this perspective, the expected incidence of impacts on fish from winter oil and gas activities under Alternative B-2 (59,342 ice road or snow trail miles) would be 23 percent less than Alternative A, 7 percent more than Alternative B-1, 42 percent less than Alternative C, and 45 percent less than Alternative D.

Effects of Water Demand

The potential types of effects on fish from water demand under Alternative B-2 would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2.

Protective guidelines under Alternative B-2 and the number of studies investigating both freshwater and seawater uses indicate that effects of water demand on freshwater, anadromous, or marine fish should be limited to local, short-term impacts. In evaluating all alternatives, the relative comparison of projected ice infrastructure should be directly related to the expected incidence of impacts on fish from winter water use. Consequently, Alternative B-2 (326,420 acres of ice pads, ice airstrips, and ice roads or snow trails) would have an incidence of impacts that is less than 1 percent less than Alternative A, 40 percent more than Alternative B-1, 25 percent less than Alternative C, and 33 percent less than Alternative D. The more production pads anticipated under an alternative, the greater the need for year-round freshwater for personnel camps. The degree of foreseeable impacts on fish from year-round domestic freshwater demand under Alternative B-2 (82 oil and gas production pads) would be 20 percent less than Alternative A, 9 percent more than Alternative B-1, 45 percent less than Alternative C, and 49 percent less than Alternative D. The year-round need for seawater for waterflooding would be proportional to the number of oil production pads that would exist for an alternative. The probable extent of potential impacts on fish from year-round seawater use under Alternative B-2 (14 oil production pads) would be 13 percent less than Alternatives A and D, the same as Alternative B-1, and 7 percent less than Alternative C.

Effects of Gravel Mining

The potential types of effects on fish from gravel mining under Alternative B-2 would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2.

Considering the well-understood impacts associated with instream and floodplain gravel mining, regulations associated with this activity, and the generally positive results demonstrated in other North Slope oil field gravel mines, negative effects on freshwater, anadromous, or marine fish under Alternative B-2 would likely be localized to small drainages where gravel pits are constructed. Foreseeable potential impacts on fish due to gravel mining would be proportional to the maximum number of gravel pits expected under each alternative. The extent of impacts under Alternative B-2 (31 or fewer gravel pits) would be 23 percent less than Alternative A, 7 percent more than Alternative B-1, 40 percent less than Alternative C, and 44 percent less than Alternative D.

Effects of Development Pads, Roads, Airstrips, and Pipelines

The potential types of effects on fish from development pads, roads, airstrips, and pipelines under Alternative B-2 would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2. Also, the same as Alternative B-1, under Alternative B-2 Teshekpuk Lake and a large area around it; Kasegaluk Lagoon and Peard Bay and a mile-wide area around them; and Elson Lagoon, Dease Inlet, and Admiralty Bay would not be available for oil and gas leasing and new non-subsistence infrastructure would be prohibited.

Under Alternative B-2, effects on fish from development pads, roads, airstrips, and pipelines, and associated activities such as vehicle and equipment traffic, personnel camps, and production drilling, should primarily occur in different areas at a small catchment scale; impacts would not be expected to have a significant effect on larger watershed populations of freshwater, anadromous, or marine fish in the NPR-A or adjacent waters. The anticipated length of roads and pipelines is representative of the relative scale of expected development under each alternative. From this standpoint, the incidence of impacts on fish from those structures and associated activities under Alternative B-2 (2,058 miles of roads and pipelines) would be 10 percent less than Alternative A, 9 percent more than Alternative B-1, 46 percent less than Alternative C, and 48 percent less than Alternative D. The incidence of impacts on fish related to gravel pads and airstrips under Alternative B-2 (121 gravel pads and airstrips) would be 22 percent less than Alternative A, 7 percent more than Alternative B-1, 43 percent less than Alternative C, and 47 percent less than Alternative D.

Effects of Causeways

The potential types of effects on fish from causeways under Alternative B-2 would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2.

Under Alternative B-2, causeways or any other structures that extend into coastal waters could impact anadromous or marine fish along local coastline areas. Under the different alternatives, susceptibility to causeway effects can be based on the estimated length of coastline within available leasing areas for each alternative (Table 4-19 in Volume 2). From this perspective, less than 10 percent of the NPR-A coastline (less than 100 miles) would be vulnerable to causeways under Alternative B-1 and B-2. Comparatively, causeways could potentially be built along 100 percent of NPR-A coastline under Alternatives A and D, and 50 percent of the coastline under Alternative C. However, under Alternatives A, B-1, and C (Lease Stipulation K-8b), Kasegaluk Lagoon would be off-limits to permanent oil and gas facilities, while under Alternatives D and B-2 a causeway or similar structure could be constructed there.

Effects of Summer Tundra Travel

The potential types of effects on fish from summer tundra travel under Alternative B-2 would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2.

Under Alternative B-2, limited summer tundra travel could affect freshwater or anadromous fish in a number of discrete lakes and streams, but would not likely have any impact on marine fish. Since most approved summer tundra travel would be related to pipeline maintenance, the length of pipelines estimated for each alternative is indicative of the relative extent of potential effects on fish from this activity. Accordingly, the expected incidence of impacts under Alternative B-2 (1,502 miles of all pipelines) would be 5 percent less than Alternative A, 8 percent more than Alternative B-1, 47 percent less than Alternative C, and 48 percent less than Alternative D.

Effects of Oil Spills and Gas Releases

The potential types of effects on fish from oil spills and gas releases under Alternative B-2 would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2. Also the same as Alternative B-1, under Alternative B-2, Teshekpuk Lake and a large area around it; Kasegaluk Lagoon and Peard Bay and a mile-wide area around them; and Elson Lagoon, Dease Inlet, and Admiralty Bay would not be available for oil and gas leasing, and new non-subsistence infrastructure would be prohibited.

Under Alternative B-2, effects on freshwater, anadromous, or marine fish from small crude or refined oil spills and from any gas release should typically be localized. Most gas releases would only present an acute, short-term threat to fish; impacts from liquid (oil and other produced fluid) spills would be much greater. Since most Alaskan North Slope industry spills have been contained on gravel pads and roads (National Research Council 2003), pipeline leaks would be the most likely source for spills that could affect fish. Consequently, the estimated extent of pipelines that would transport liquids under each alternative represents a practical relative risk to fish from small spills. The risk under Alternative B-2 (1,162 miles of pipeline for oil and two- or three-phase produced fluids) would be 14 percent less than Alternative A, 10 percent more than Alternative B-1, 52 percent less than Alternative C, and 53 percent less than Alternative D.

Effects on fish from large oil spills, if a substantial portion reached freshwater, could impact freshwater and anadromous fish populations at a watershed level. If a considerable quantity of a large oil spill reached coastal waters, this could potentially impact anadromous or marine fish populations. The percent chance of one or more large oil spills (Table 4-16 in Volume 2) under Alternative B-2 (30 percent) is less than Alternative A (37 percent), Alternative C (37 percent), and Alternative D (39 percent), but more than Alternative B-1 (28 percent).

Effects of Abandonment and Reclamation

The potential types of effects on fish from abandonment and reclamation under Alternative B-2 would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2.

Effects (negative or positive) on freshwater, anadromous, or marine fish from oil and gas abandonment and reclamation under Alternative B-2 should only occur at individual lakes, small stream reaches, or limited coastline areas. The total area of surface disturbance under the different alternatives should reflect the relative magnitude of potential effects on fish from abandonment and reclamation. As such, Alternative B-2 (14,751 acres of permanent pads, roads, pipelines, and gravel pits) would have an expected incidence of impacts that is 11 percent less than Alternative A, 10 percent more than Alternative B-1, 46 percent less than Alternative C, and 48 percent less than Alternative D.

4.5.7.3 Effectiveness of Stipulations and Best Management Practices

The best management practices and lease stipulations under Alternative B-2 would mitigate potential impacts on fish from oil and gas activities to the extent that effects would likely occur in localized areas and only a large oil spill would be expected to potentially affect fish at the population level. The effectiveness of these best management practices and lease stipulations would be the same as described under Alternative B-1 in section 4.4.7.3 of Volume 2.

4.5.7.4 Conclusion

The potential impacts to freshwater, anadromous, and marine fish from oil and gas exploration and development activities within the NPR-A under Alternative B-2 broadly include acoustic disturbance, injury at water-use intakes, altered water quality, physical habitat changes (water quantity, flow patterns, and geomorphology), point and non-point source pollution, increased turbidity and sedimentation, and barriers to fish movements. These impacts can collectively contribute to reduced success at different life history stages, behavioral changes, diminished condition, susceptibility to pollutants or disease, shifts in fish species distribution, and mortality. The best management practices and lease stipulations in Alternatives B-1, B-2, C, and D and the corresponding required operating procedures and lease stipulations in Alternative A would essentially provide the same level of protection to fish. The major exception is that Alternative D has no comparable provisions to Lease Stipulations K-3a and K-3b in Alternatives A, B-1, B-2, and C and

Alternatives D and B-2 have no comparable provision to Lease Stipulation K-8b in the other alternatives.

The fundamental difference among the various alternatives regarding potential effects on fish is the extent of land that would be open for leasing to conduct oil and gas activities and the distribution of those lands within the NPR-A Fish Habitat Units (Map 3.3.4-1; Table 4-19 in Volume 2). Under Alternative B-2, NPR-A lands available for leasing include 17,300 miles of potential stream habitat. This is 3 percent less than Alternative A, 6 percent more than Alternative B-1, 32 percent less than Alternative C, and 49 percent less than Alternative D. The amount of potential lake habitat within lands that may be leased in Alternative B-2 (1,001,500 acres of lake surface area) is 38 percent less than Alternative A, 1 percent less than Alternative B-1, 39 percent less than Alternative C, and 47 percent less than Alternative D. The distribution of these waterbodies in different NPR-A Fish Habitat Units is described in Table 4-19 in Volume 2.

If predicted shifts in physical and chemical characteristics of the environment occur with climate change (e.g., Scenarios Network for Alaska Planning 2010), impacts on fish from oil and gas activities under Alternative B-2 could be greater or less than expected. The factors related to this are the same as those described for Alternative A.

4.5.8 Birds

This section discusses the potential effects to non-special status bird species that could result from management action in the planning area under Alternative B-2. A discussion of effects to threatened and sensitive bird species is given in section 4.3.11, "Special Status Species" in Volume 2. Most of the activities that could potentially affect birds in the planning area would result from oil and gas exploration and development. Other activities that could potentially affect birds in the planning area include permitted recreational use, guided hunting, activities associated with scientific surveys and research camps, cleanup of old oil and gas exploration sites, and activities associated with government actions (e.g., cleanup of abandoned well sites). These activities could affect tundra-nesting birds by causing: (1) habitat loss, (2) disturbance or displacement (3) increased predation, and (4) direct mortality. Impacts would most often be localized and on the scale of individual birds. Impacts have potential to have greater negative effect if the activity occurs in an area of high bird density (such as near lakes containing large numbers of molting geese or shorebird nesting and staging areas) or in areas containing populations of species known to have declining populations or those particularly sensitive to disturbance. Alternative B-2 would make available 52 percent (11.8 million acres) of the NPR-A for oil and gas leasing, although leasing in lands currently deferred from leasing (see Alternative A) would not be offered for lease, pending expiration of the deferrals (see Map 2-2). Approximately 11 million acres would be unavailable for leasing and five special areas containing 13.35 million acres would be allocated. Management practices would emphasize performance-based stipulations and best management practices on surface activities, consultation with local residents, and coordinated scientific studies to protect wildlife habitat, subsistence use areas, and other resources.

4.5.8.1 Activities Not Associated with Oil and Gas Exploration and Development

Under Alternative B-2, activities not related to oil and gas exploration and development that could affect birds in the planning area would be the same as those described under Alternative A: air traffic, aerial surveys to inventory wildlife or other resources, summer research activities, hazardous material or debris removal, and permitted recreational camps and boating activity. As compared to Alternative A, impacts to birds from non-oil and gas activities could be less frequent, lesser in extent, or shorter in duration under Alternative B-2. This is because of best management practices as well as large areas in which lands are unavailable for oil and gas leasing and areas where new non-subsistence infrastructure would be prohibited from large areas important for birds, and because the lesser amount of oil and gas activity projected in this alternative may reduce the amount of non-oil and gas activity by reducing the impetus for scientific studies. Fewer individual animals likely would be exposed to human activities, including aircraft traffic and aerial surveys. Impacts generally would be localized, and the disturbance reactions of birds would likely be brief. Some birds might avoid scientific and recreation camps during the 6 to 12 weeks of activities, while some birds (e.g., ravens) could be attracted to the camps. Best management practices (see Table 2-3 in Volume 1 for specifics) and large areas in which lands are unavailable for oil and gas leasing and areas where new non-subsistence permanent infrastructure is prohibited protects birds and their habitats, and would help to mitigate the potential effects of non-oil and gas activities on birds under Alternative B-2.

4.5.8.2 Oil and Gas Exploration and Development Activities

Exploration

Ground-based seismic surveys and exploration activities would occur during the winter months when birds are mostly absent from the planning area. Under Alternative B-2, the types of effects of winter exploration activities would be the same as those discussed under Alternative A. Although the same number of seismic surveys is estimated to take place under both Alternatives A and B-2, the actual area covered by those surveys is expected to be greater in Alternative B-2. The use of air guns for boat-based seismic work would not be allowed in several large coastal bays and lagoons because those lands would be unavailable for leasing (Dease Inlet, Admiralty Bay, Elson Lagoon, Kogru River, Peard Bay, Wainwright Inlet/Kuk River, Kasegaluk Lagoon, and their associated islands). The direct effects of ground-based exploration activities would likely include the temporary displacement of a small number of birds (e.g., ptarmigan and gyrfalcons) from preferred winter feeding or roosting areas.

Alternative B-2 prohibits exploration activities in the same areas and manner as Alternative A (i.e., in Dease Inlet, Admiralty Bay, Elson Lagoon, and associated islands). However, unlike Alternative A, it adds other high-quality bird habitats to the prohibition. This includes Kasegaluk Lagoon, Wainwright Inlet/Kuk River, and Peard Bay, and their associated barrier islands within NPR-A, would be unavailable for leasing, in addition to the named and unnamed bays, lagoons, and other coastal waters within the NPR-A boundary east of Barrow, In the case of Peard Bay and Kasegaluk Lagoon, lands within 1 mile of those two waterbodies would be unavailable for leasing. These areas are very important to many migratory species of waterbirds and shorebirds during critical life stages such as migration staging, molting, and breeding, and therefore, birds would benefit greatly from the protection. During winter, seismic activities would be allowed in these areas (but no shorebirds or waterbirds are present. The types of effects that could result from the construction and use of ice roads and ice pads would be the same under Alternative B-2 as those described under Alternative A, and would primarily involve the temporary alteration of tundra habitats. However, a smaller area (due to large areas that are unavailable for leasing) would be available to oil and gas exploration activities under Alternative B-2, as compared to any of the other alternatives. Therefore, the potential impacts to birds resulting from exploratory activities would likely be less under Alternative B-2 than under any of the other alternatives.

Alternative B-2 contains the same measures as all other alternatives to avoid human-caused increases in predator populations. This includes Required Operating Procedure/Best Management Practice A-2 and Stipulation E-9, which would minimize the availability of anthropogenic food (e.g., garbage) and shelter, respectively that could be utilized by predators. Similarly, measures addressing proper handling of hazardous materials associated with the drilling process and accidental spills are the same among all alternatives as well (i.e., Required Operating Procedures/Best Management Practices A-1 through A-7). Therefore, Alternative B-2 offers no advantage or disadvantage to birds from the handling of waste products.

Under Alternative B-2, oil and gas exploration wells would create an estimated combined short-term ground disturbance of 456 acres, and a long-term ground disturbance of less than 1 acre. Delineation wells would impact the same number of acres, although not necessarily in the same locations as the exploration wells. This is the least amount of short-term bird habitat loss predicted for any alternative, with about 20 percent less than the next lowest alternative (Alternative B-1) and 45 percent less than Alternative A. There is essentially no (less than 1 acre) long-term habitat loss predicted from exploration activities in any alternative.

Development and Production

Under Alternative B-2, the types of development and production activities would be the same as those discussed under Alternative A. In order to mitigate the potential negative effects of activities associated with the oil and gas development and production activities Alternative B-2 includes a large number of applicable stipulations and BMPs, some of the most important are: Stipulations E-2, F-1e, G-1, K-2, K-3 b, K-6, and Best Management Practices A-2a and b, B-2, E-9, E-10, E-11, K-4a, K-8b. Stipulations K-4a and K-6 in Alternative B-2 offer greater protection to birds than do the corresponding stipulations in Alternative A. However, because the amount and location of activities could be different under Alternative B-2, effects to birds could also vary as discussed in detail below.

Habitat Loss

Of all activities, gravel mining and placement for the construction of oil and gas field infrastructure would have the greatest potential to result in the permanent loss of bird habitat. Under Alternative B-2, it is estimated that a total of 530acres would be disturbed for oil central processing facilities and gas compressor facilities (see Table 4-14 in Volume 2). In conjunction with these facilities, other support structures would also be needed, such as gravel production pads, runways, and roads. Under Alternative B-2, the gravel footprint (total long-term disturbance) of these production facilities would be 8,402 acres (Table 4-14 in Volume 2). Of all the alternatives, Alternative B-2 is predicted to create the second lowest amount of long-term surface disturbance, with about 10 percent more surface disturbance than Alternative B-1 and about 20 percent less than Alternative A. Much of the area unavailable for leasing in Alternative B-2 is of very high values to many species of birds.

In addition to permanent habitat loss, temporary loss of tundra habitat adjacent to gravel roads and pads could occur as a result of thermokarst, dust deposition, snow accumulation, water withdrawals (if recharge does not occur), and impoundment formation. Under Alternative B-2, the types of effects to birds resulting from temporary habitat loss would be the same as those discussed under Alternative A. However, the potential for loss would likely be less under Alternative B-2 than any other alternative, because of the larger area unavailable for leasing, the resultant reduced need for infrastructure, and the protections imposed on some areas that contain large numbers of birds. The extent of effects from temporary habitat loss would depend on the species and numbers of individuals occurring in areas adjacent to the development.

Bird mortality could result from collisions with vehicles (ground and air) or structures such as elevated pipelines, buildings, drilling rigs, towers, power lines if suspended, boats (including barges), or bridges. Under Alternative B-2, the types of effects to birds resulting from collisions with structures would be the same as those discussed under Alternative A although the potential for collisions would be lower in Alternative B-2 due to the larger area unavailable for leasing and the resultant reduced need for infrastructure. The magnitude of potential impacts to bird populations as a result of collisions in areas of oil and gas development will depend, among other variables, on the location and type of the structure, the species involved, the lighting regime employed, and the weather conditions. Birds would likely be impacted at the level of the individual and not at a population level. The expected number of sealifts in Alternative B-2 would be lower than in the other alternatives, as the amount of supplies needed to build oil and gas infrastructure would be reduced due to the fewer facilities estimated to be needed, so the impacts from bird collisions with barges would also be lower in Alternative B-2.

Disturbance

The potential for disturbance to birds from ground-based travel on roads, within pads, and cross-tundra would likely be less under Alternative B-2 than any other alternatives, because Alternative B-2 would make unavailable to leasing approximately 11 million acres of the NPR-A from oil and gas leasing (including a large tract of important bird habitat east and west of Dease Inlet and around Teshekpuk Lake), and the resultant reduced need for pads, pipelines, roads, and associated infrastructure. In addition, this alternative would enlarge special areas and create one new special area. Potential impacts from summer cross-country travel on tundra would be limited in Alternative B-2, the same as all other alternatives, and would only be allowed on a case-by-case basis, and only after extensive studies have been conducted (Required Operating Procedure/Best Management Practice L-1).

Aircraft, both fixed-wing and helicopter, would provide access for oil and gas-related activities throughout the development, and operation and abandonment of any oil or gas field developed in the NPR-A. The types of disturbance effects to waterfowl and other bird groups from aircraft would be the same under Alternative B-2 as those discussed under Alternative A, and could include displacement from preferred feeding habitats, temporary or permanent nest abandonment, and temporary or permanent displacement from staging, molting, or brood-rearing areas. Aircraft disturbance would be likely to affect birds in those portions of the NPR-A open to development, with the effects being lowest in Alternative B-2, second in Alternative B-1, with the most disturbance likely to occur in Alternatives C and D.

The types of disturbance effects to waterfowl and other bird groups from watercraft would be the same under Alternative B-2 as those discussed under Alternative A, and could include displacement from preferred habitats and nest abandonment. As the expected number of sealifts in Alternative B-2 would be lower than in the other alternatives, the impacts from bird collisions with barges would also be lower in Alternative B-2.

Oil spill response training activities using watercraft could be conducted on rivers and lakes several times during the open-water period. The potential for disturbance to birds from these activities would likely be less under Alternative B-2 than in any other alternative, because of the larger area unavailable for leasing, the resultant reduced need for infrastructure, and the protections imposed on some areas that contain large numbers of birds. The extent of effects to birds from oil spill and gas release response activities would depend on the species and numbers of individuals occurring in areas within and adjacent to the impacted area.

Predation

Some predators, such as raven, gulls, arctic fox, and bear could be attracted to areas of human activity where anthropogenic sources of food and denning or nesting sites were present. The potential impacts of increased numbers of predators on birds are discussed under Alternative A. Increased predation pressure could have moderate impacts on tundra-nesting birds. Under Alternative B-2, the types of effects to bird populations would be the same as those discussed under Alternative A. Under Alternative B-2, there would be less potential for bird mortality due to predation than under the other alternatives, as there would be fewer anthropogenic sources of food available.

Abandonment and Reclamation

Development scenarios indicate that at abandonment of the field, gravel pads and roads may or may not be removed and that reclaimed or abandoned pads may be revegetated by native vegetation or would be allowed to bed naturally. Given that scenario, it is very difficult to determine potential effects to birds from these unknown activities. For this document, it is assumed that all gravel will be removed after abandonment. Given that assumption, the impacts of abandonment and reclamation of oil and gas fields on birds would be similar in many respects to those incurred by construction activity. The types of impacts would be the same for Alternative B-2 as described in Alternative A. However, Alternative B-2 would likely have the least impact of any alternative, as less area would be available for oil and gas development, resulting in less total area to be abandoned and subsequently rehabilitated.

Oil Spills and Gas Releases

Under Alternative B-2, the types of effects to birds resulting from oil and seawater spills and gas releases would be the same as those discussed under Alternative A.

Although the estimated large oil spill volume is the same for all alternatives, the probability of a spill occurring is notably less under Alternative B-2 (30 percent) than under Alternatives A, C, and D (37, 37, and 39 percent, respectively) and slightly higher than under Alternative B-1 (28 percent). This difference is due to the greater size of the unavailable lands within areas of high potential for oil discovery in Alternative B-2, thus reducing the anticipated oil recovery. Even with the protection of particularly sensitive areas (e.g., coastal shoreline and goose molting area), and the substantial emphasis on spill prevention and response, if a large crude oil spill occurred, it could have a measurable effect on birds at a population level. Effects to individual birds could range from short-term disturbance to death. Impacts to birds on a population level could occur if oil from a large spill entered rivers, important molting or brood-rearing lakes, or marine areas during periods when large proportions of specific populations (e.g., brant, long-tailed ducks, eiders, and shorebirds) were present. Many factors would determine the probability that birds would be negatively impacted by a large oil spill, including the quantity spilled, season, location (e.g., land versus water), and proximity to sensitive habitat. Although the probability of a spill varies by alternative, the impacts to individual birds from large crude/refined oil spills would be the same as under all alternatives if a spill were to occur in a location where birds were present.

Oil entering a river or stream could potentially spread into delta or coastal areas, where impacts to loons, waterfowl, and shorebirds could be more severe. Under all alternatives, the potential that an oil spill would enter a major river or stream would be minimized by Stipulation K-1. This stipulation would provide setbacks from specified rivers, within which permanent oil and gas facilities would be prohibited, although pipelines would not necessarily be prohibited in some of these areas.

Oil spilled (from a barge or support vessel) into marine habitats would have the potential to spread oil over a larger area than in terrestrial habitats due to winds and currents; therefore, birds found in marine habitats within NPR-A could be particularly susceptible to the negative impacts of an oil spill. The reduced need for marine transportation under Alternative B-2 relative to the other alternatives, with the exception of Alternative B-1, would reduce the opportunity for a spill to occur. For further discussion of potential effects of marine spills, see Alternative A.

A gas release from a well is expected to last one day and to release 10 thousand cubic feet of gas, while a release from a transmission pipeline or processing facility is estimated to release 20 thousand cubic feet over a few hours. Although the estimated release volume is the same for all alternatives, the difference in the estimated number of gas production wells and lengths of various pipelines would change the probability of a release among the alternatives. The potential for disturbance to birds from a gas release would likely be less under Alternative B-2, as compared to all other alternatives, except for Alternative B-1, because of the larger area unavailable for leasing, the resultant reduced need for infrastructure, and the protections imposed on some areas that contain large numbers of birds.

4.5.8.3 Effectiveness of Stipulations and Best Management Practices

The central theme of Alternative B-2 is the designation of large areas of the NPR-A as unavailable to oil and gas leasing, prohibition of new non-subsistence infrastructure within some of the unavailable to leasing areas, the creation and expansion of special areas, and the protection of marine habitat and shorelines important for marine animals, waterfowl, and shorebirds. These unavailable lands and designated special areas result in the protection of many natural resources including birds and bird habitat.

Alternative B-2 would make unavailable approximately 11 million acres of the NPR-A from oil and gas leasing. About 25 percent of this land is in the northeast area of the NPR-A and it includes, among other values, important waterfowl and shorebird habitat, and this unavailable designation supersedes the current time-limited (2018) deferral north and east of Teshekpuk Lake. Other lands would be unavailable for leasing in Alternative B-2 to protect marine habitat and shorelines important for marine animals, waterfowl, and shorebirds. Kasegaluk Lagoon, Wainwright Inlet/Kuk River, and Peard Bay, and their associated barrier islands within NPR-A, would be unavailable for leasing, in addition to the named and unnamed bays, lagoons, and other coastal waters within the NPR-A boundary east of Barrow. In the case of Peard Bay and Kasegaluk Lagoon, lands within 1 mile of those two waterbodies would be unavailable for leasing.

Alternative B-2 would enlarge two existing special areas and create one new special area (see section 2.3.2.2 in Volume 1). The Teshekpuk Lake Special Area would be expanded and 86 percent of this special area is unavailable to oil and gas leasing in order to better protect, among other values, waterbird and shorebird habitats. Alternative B-2 would add approximately 3.1 million acres to the Utukok River Uplands Special Area. Alternative B-2 would also create a Peard Bay Special Area to protect, among other values, habitat for waterbird and shorebird breeding, molting, staging, and migration. The boundary of the Colville River Special Area would not change, but setbacks for the Colville, Kikiarorak, and Kogosukruk rivers would be widened to 2 miles and its purpose would be modified to protect all raptors, rather than the original intent of protecting arctic peregrine falcons.

All alternatives, including Alternative B-2, contain numerous stipulations and best management practices that would effectively protect birds and their habitats in the NPR-A (see Alternative A for a full listing). The "A" best management practices provide provisions that require disposal of garbage and other waste materials in a manner that will avoid attracting wildlife to the area and reduce the potential for human-caused increases in predator populations. The "B" best management practices would help limit the impact of water withdrawals on lakes, or lake habitats, used by birds, while the "C" best management practices govern seismic ground operations to prevent seismic activity-related disturbance to birds and provide protection for over-wintering fish and invertebrates which are sources of food for many birds. The goose molting area within the Teshekpuk Lake Special Area is protected by virtue of the unavailable to leasing and no new non-subsistence infrastructure designations provided by Alternative B-2. The "K" stipulations add a number of important restrictions in areas that Best Management Practice K-4a, which under Alternative B-2, prohibits permanent oil and gas facilities (except pipelines) within 1 mile of the shorelines of goose molting lakes. This best management practice applies to off-lease activities to develop valid existing NPR-A leases, as the goose molting area within the Teshekpuk Lake Special Area is unavailable for leasing for the life of this plan. In addition, there are numerous best management practices and stipulations that regulate the types of activities that can occur near waterbodies, including rivers and streams, types of equipment that can be used, and types and timing of exploration and development activities that can be conducted in the planning area, to protect birds and their habitats.

Finally, Alternative B-2 provides stipulations and best management practices along with unavailable designations that provide protection to surface resources that is superior to the other alternatives. As there has been no oil or gas development yet in the NPR-A, it is difficult to determine the effectiveness of the above-mentioned best management practices and stipulations. Best management practices and stipulations that have been in effect in the NPR-A to date regulate exploratory activities, and thus far, seem to be effective in protecting birds and bird habitats.

4.5.8.4 Conclusion

Like Alternative B-1, Alternative B-2 emphasizes the protection of surface resources. It makes approximately 11.8 million acres of federally owned subsurface (52 percent of the total in the NPR-A) available for oil and gas leasing (Map 2-2-2) and approximately 11 million acres of the NPR-A unavailable for oil and gas leasing. Approximately 3.1 million acres between Atigaru Point (and waters within NPR-A near the point) in the east to Ukpeaġvik Iñupiat Corporation (Barrow village corporation) lands on the west would be unavailable for leasing this area encompasses and supersedes the current time-limited (2018) deferral for lands north and east of Teshekpuk Lake. Alternative B-2 makes lands unavailable for leasing in the Arctic Coastal Plain east of Barrow and makes lands currently under lease and near lands currently under lease in northeastern NPR-A near Fish Creek available and makes lands between Barrow and Dease Inlet/Admiralty Bay unavailable. Of the lands currently deferred from leasing, some in northwestern NPR-A would be made available in 2014 for leasing after expiration of the deferral described in Alternative A. Other currently deferred lands would not become available because, under this alternative, they would be unavailable for leasing. While this plan makes no decisions regarding a corridor for infrastructure associated with offshore development in the Chukchi or Beaufort seas, such a corridor could be accommodated in this alternative, subject to appropriate conditions developed through a NEPA process. This infrastructure would not be allowed on lands where new non-subsistence permanent infrastructure is prohibited, but no other provision of this alternative would directly or indirectly prohibit infrastructure in support of offshore development in the Chukchi or Beaufort seas.

Alternative B-2 emphasizes the protection of surface resources and after B-1 would be most favorable for birds. It would designate a high number and acreage of special areas, most of which purposefully include very high-value bird habitats. This alternative would also make the largest amount of high value bird habitat unavailable for leasing and much of it unavailable to new non-subsistence infrastructure; therefore, there would be a reduced amount of infrastructure that could cause habitat loss, disturbance, or mortality to birds.

Alternative B-2 would enlarge two existing Special Areas and create one new Special Area. It would add approximately 1.9 million acres to the Teshekpuk Lake Special Area to protect caribou calving and insect-relief areas and waterbird and shorebird breeding, molting, staging, and migration habitats. The purpose of the Teshekpuk Lake Special Area would be expanded to include the protection of important caribou and shorebird habitat as well as waterbird habitat, which was the original purpose for the Special Area. Alternative B-2 would also add approximately 3.1 million acres to the Utukok River Uplands Special Area to more fully encompass prime calving and insect-relief habitat within the NPR-A and would create a 107,000-acre Peard Bay Special Area to protect haul-out areas and nearshore waters for marine mammals and a high use staging and migration area for shorebirds and waterbirds. The boundaries of the Colville River Special Area and Kasegaluk Lagoon Special Area would not change, but the purpose of the former would be modified to protect all raptors, rather than the original intent of protection for arctic peregrine falcons. Non-oil and gas activities that could potentially affect birds would be the same as those in Alternative A. Under all alternatives, this analysis shows that impacts to birds from non-oil and gas activities would be minor.

A lower overall level of development would likely occur under Alternative B-2, as compared to all other alternatives except of Alternative B-1. The potential for habitat loss and alteration to affect birds would be less under Alternative B-2, as compared to all other alternatives except Alternative B-1, and the amount of high-value bird habitat that would be lost to gravel infrastructure would be much less than in Alternatives A, C and D. The potential for bird mortality resulting from collisions with vehicles (air or ground) or infrastructure and marine vessel traffic would be less under Alternative B-2 because the amount of infrastructure and barge traffic would be less than in the other alternatives. The potential for an oil spill to impact birds would also be less under Alternative B-2, as compared to the other alternatives, with the exception of Alternative B-1, given the estimated lower amount of infrastructure and development activity, and the large amount of protection afforded to coastal areas in this alternative.

Under Alternative B-2, the types of disturbances related to vehicle, aircraft, pedestrian, and vessel traffic, routine maintenance activities, heavy equipment use, facility noise, and oil spill and gas release cleanup activities would be similar to those described under Alternative A. The potential for these disturbances to impact birds would be far less under Alternative B-2 than under all other alternatives except for Alternative B-1, as a large portion of the high-use bird habitat in the planning area is unavailable for leasing.

Stipulations and best management practices established under Alternative B-2 would help to mitigate potential impacts to birds. Effectiveness of stipulations and best management practices are unknown at this time, but are likely to be effective.

In general, impacts to birds from non-oil and gas activities, and from oil and gas exploration and development activities, would be additive. Potential impacts from seismic activity would vary by alternative, with Alternatives A and B-2 each expecting to require five exploratory and six developmental seismic surveys. Alternative B-2 is expected to require greater area coverage by seismic survey than does Alternative A, so the total area impacted by seismic survey in Alternative B-2 will be larger than that in Alternative A (see Table 4-11 in Volume 2). This larger area of potential seismic activity would likely avoid many high value bird habitats as many of those areas are unavailable for leasing in this alternative. The expected number of oil and gas fields and the level of development under Alternative B-2 would be lower than under all of the other alternatives except for Alternative B-1. Therefore, it is expected that the potential effects of disturbance, habitat loss and alteration, and bird mortality due to oil and gas exploration and development under Alternative B-2 would be lower that under any of the other alternatives, except for Alternative B-1, presented in this plan. The sum of effects from all activities authorized under this alternative, barring a large oil spill, would likely produce no measureable effect on migratory bird populations of any species. All alternatives would minimize unintentional take of migratory birds and conserve migratory bird populations.

Although many of the forces driving global climate regime shifts may originate outside the Arctic, the impacts of global climate change are exacerbated in the Arctic (Arctic Climate Impact Assessment 2004). Temperatures in the Arctic have risen faster than in other areas of the world, as evidenced by glacial retreat and melting of sea ice. Given that, bird species whose range in Alaska is concentrated in the Arctic may be the most vulnerable to the effects of a changing climate. These species include snow goose, king eider, red phalarope, stilt sandpiper, ruddy turnstone, pomarine jaeger, snowy owl, and Smith's longspur, among others. Effects to birds from climate warming may include a suite of effects, both positive and negative. A longer open-water season may increase productivity of some species of shorebirds and increase productivity in aquatic and semi-aquatic systems, which provide food for many species of birds.

Warmer soil temperatures are likely to increase thermokarst, and increases in sea level may inundate low-lying tundra areas, increasing salt marsh, aquatic and wet tundra vegetation types, and erosion of coastal bluffs (Arctic Climate Impact Assessment 2004) causing changes in coastal habitats that may quickly result in changes in vegetation that influence habitat suitability and availability for birds (Mars and Houseknecht 2007). The increasing thickness of the active layer of soil above arctic permafrost is likely to cause changes in moisture regimes and the distribution of vegetation types over much of the Arctic in coming years. Drying of wetlands would result in negative effects to those species that rely on shallow water and wet meadows, and shrub expansion may reduce the quality and availability of some types of habitats. Such impacts could accelerate or exacerbate changes in soil thermal regimes that occur with development, potentially leading to greater impacts to bird habitat.

Melting sea ice may affect a few bird species, such as black guillemot that feed near the ice edge and may not be able to bring high-quality food to their young as the pack ice moves farther offshore. Increase in human economic activities such as shipping and offshore oil and gas development may influence the abundance and distribution of predators, which may negatively affect bird populations. These changes may be beneficial to some species such as those associated with boreal forest or shrub habitats, but a reduction in the amount of tundra habitat available could negatively impact tundra-nesting shorebirds and waterfowl and add to the cumulative effects of oil and gas development. High rates of coastal erosion and storm surges have led to saltwater intrusion into freshwater habitats, and such intrusions are expected to have altered goose foraging habitats, and may be the cause of the observed spatial redistribution of geese in the Teshekpuk Lake Special Area (U.S. Geological Survey 2006).

4.5.9 Terrestrial Mammals

4.5.9.1 Activities Not Associated with Oil and Gas Exploration and Development

Impacts to mammals from non-oil and gas activities would essentially be the same as those discussed under Alternative A. No further analysis is necessary.

4.5.9.2 Oil and Gas Exploration and Development Activities

Alternative B-2 emphasizes protection of surface resources, while making nearly 11.8 million acres of federally owned subsurface (52 percent of the total NPR-A) immediately available for oil and gas leasing. In addition, lease stipulations would provide seasonal and spatial protection to certain environmentally sensitive areas, including Deep Water Lakes, Colville River Special Area and Coastal Area, Teshekpuk Lake, and areas near rivers. The exploration scenario under Alternative B-2 assumes that one 2-D and ten 3-D seismic surveys would be conducted over the next 30 years; the same number as for Alternative A, but involving 9 percent more acreage. It also assumes that 152 oil or gas exploratory or delineation wells, 78 percent of those assumed under Alternative A, would be drilled from winter ice pads over that period. The development scenario under Alternative B-2 assumes that 8 central processing facilities for oil and 21 central processing or compressor facilities for gas along with associated production pads and other facilities would be developed in the NPR-A. The exposure of terrestrial mammals to oil and gas activities, and therefore, the level of associated impact, would be less under Alternative B-2 than under all other alternatives except B-1, given that leasing of lands in a broad area around Teshekpuk Lake would not occur and the overall scale of development is assumed to be less under Alternative B-2. Using the same rationale, Alternative B-2 could be expected to pose slightly greater impacts to terrestrial mammals than would Alternative B-1.

Effects of Disturbances

Seismic Activities

Impacts to terrestrial mammals would be nearly the same as those discussed under Alternative A, because it is assumed that the number of terrestrial seismic operations would be the same under both alternatives, but cover 9 percent more acreage under Alternative B-2. The greater change is that seismic surveys would not occur in the broad area around Teshekpuk Lake where no leases would be offered under Alternative B-2. It is expected that the reactions of caribou and other terrestrial mammals to disturbance would be brief, and that fewer numbers of wintering Teshekpuk Caribou Herd caribou would likely be encountered (see Alternative A for a description of potential adverse impacts). Some caribou and other large mammals would likely be displaced from the general area of the seismic work. Some terrestrial mammals would avoid seismic camps, while others, such as foxes, could be attracted to the camps by food odors. The potential for disturbance to hibernating grizzly bears would remain, but bears are present at low density. Impacts to moose would likely be the same as for Alternative A, since there would be no change for the Colville River area where most NPR-A moose winter. Muskoxen may not be affected at all, because all areas currently known to be occupied by mixed-sex groups would be unavailable for leasing.

Under Alternative B-2, Teshekpuk Lake would remain unavailable for leasing. There would be no summer seismic exploration on the lake, and therefore, no disturbance of terrestrial mammals near the lake due to such activity.

Exploratory Drilling

Under Alternative B-2 it is projected that the number of exploration and delineation wells drilled (152) would be less than Alternative A, and even fewer in comparison to Alternatives C or D, but more than under Alternative B-1. Impacts to terrestrial mammals would be similar to those discussed under Alternative A, but somewhat less in spatial extent, frequency, and magnitude. This would especially be so in the areas where leasing would be excluded under Alternative B-2 (the area surrounding Teshekpuk Lake and from there northwest to where non-federal lands begin near Barrow). Exploratory drilling would be conducted during the winter, when some mammal species are less active or less often present, although wintering Teshekpuk Caribou Herd caribou could be present in large numbers. Grizzly bears may experience a reduced level of impacts than under Alternative A, depending on their winter distribution. There may be no difference for moose, or possibly muskoxen, between Alternatives A and B-2, due to their distributions relative to where drilling operations may occur. This assumes their distributions would remain similar over the next 30 years to what they are today.

The implementation of lease stipulations and best management practices would minimize impacts to terrestrial mammals by including (1) provisions to avoid known grizzly bear dens by one-half mile, (2) methods to avoid attracting wildlife to food and garbage, (3) provisions to protect streambanks from damage during overland moves, and (4) provisions to minimize the effect of low-flying aircraft on wildlife (particularly over caribou winter ranges).

Oil and Gas Development

Approximately 52 percent of the NPR-A would be made available for leasing under Alternative B-2. Large blocks in the northeast and southwest portions would be excluded from leasing.

The primary effects of oil and gas development on terrestrial mammals would be similar to those outlined under Alternative A, and would result from construction of facilities such as roads and pipelines; motor vehicle traffic within the oil and gas field(s) and on connecting roads; foot traffic near facilities and camps; aircraft traffic; crude-oil and fuel spills contaminating tundra, fresh water, and coastal habitats; and habitat alteration associated with gravel mining and construction. The greatest potential for impacts to caribou would be through disruption of calving areas and interference in the movement of mosquito-harassed Teshekpuk Caribou Herd caribou between insect-relief habitat and foraging areas, but this would be almost completely eliminated under Alternative B-2 due to the two large blocks excluded from leasing. Thus, impacts would likely be less under Alternative B-2 than under Alternative A, given the smaller development scenario that would create less disturbance and affect about 19 percent fewer acres of habitat under long-term disturbance. Functional loss of habitat would be greater than the number of acres indicated as the actual development footprint. Wolfe (2000) suggested that when caribou in the Central Arctic Herd avoided areas within 2.5 miles of roads (during calving season), the functional habitat loss increased from 2 percent (the immediate footprint of roads and gravel pads) to 29 percent.

Caribou, moose, muskoxen, grizzly bears, wolves, wolverines and foxes could be locally affected by activities associated with oil and gas exploration and development. Impacts to mammals would be similar to those discussed under Alternative A, but could be less frequent, lesser in extent, or shorter in duration. A smaller number of individual animals would likely be exposed to human activities. Aircraft traffic would less often pass over caribou and other terrestrial mammals during flights, and less habitat would potentially be permanently lost.

Construction of permanent roads within the NPR-A would increase access to the area and could increase sport and subsistence hunting of terrestrial mammals if those roads were ever connected to villages or other road systems. Among ungulate species, caribou would be most impacted by increased access for hunting, but other species (moose in particular) may also be impacted, depending on the location of permanent roads. The overall number of animals taken would be unlikely to increase dramatically since most hunting would be for subsistence purposes, but roads could focus hunts in particular portions of the NPR-A. Hunting pressure and harvests have increased for many wildlife species near the Trans-Alaska Pipeline System since its construction, but have not produced adverse population effects (Trans-Alaska Pipeline System Owners 2001). It is unlikely that the more remote roads associated with oil and gas development in the NPR-A would have as great an effect on wildlife populations as occurred along the Trans-Alaska Pipeline System corridor.

Caribou – Although much of the construction associated with oil and gas development would occur primarily during winter, development would bring year-round facilities and activities to caribou range. If a field were developed in the area available for leasing northwest of Nuiqsut, or in the large area south of Barrow and surrounding Atqasuk, production pads, pipelines, within-field roads, and other facilities would be located within a small portion of the area used by the Teshekpuk Caribou Herd for calving and a larger portion of the areas used for insect relief and wintering. Wilson and Loya (2012) and Wilson (personal communication) suggest through their modeling efforts that the remaining high-quality calving habitat following development would be 91 percent (95 percent confidence interval: 87-93 percent) for Alternative B-2, significantly more than the 78 percent for Alternative A. A field development in these areas would also require a connector pipeline to link the oil or gas fields with facilities to the east.

The types of impacts of field development on caribou would be similar to those outlined under Alternative A. However, given the reduced possibility that a field would be developed within the calving, insect-relief, and wintering grounds of the Teshekpuk Caribou Herd caribou, impacts to caribou could be less under Alternative B-2 than under Alternative A. Overall, the level of impact would depend on the specific location of any oil or gas field. For example, a field in the central or northwestern portion of the NPR-A would likely not impact the Teshekpuk Caribou Herd caribou calving grounds, although such a development could still affect migratory movements of Teshekpuk Caribou Herd and Western Arctic Herd caribou, as well as activities on their wintering ground. Under Alternative B-2, the Western Arctic Herd caribou could be exposed to oil or gas development facilities in only localized areas outside of their core summer habitats.

Traffic associated with hauling gravel from outside of the NPR-A could result in local disturbance and displacement of caribou within one to a few miles of the operations. A pipeline linking oil or gas fields in the NPR-A with facilities at the Alpine and Kuparuk oil fields, or directly to the Trans-Alaska Pipeline System at Pump Station 2, would result in the disturbance and displacement of some caribou during winter construction, due to air traffic and vehicle traffic along ice roads. It is expected that these disturbances would be short term (but see Alternative A's discussion of potential effects of seismic operations) and occur within about one to a few miles of the pipeline corridor.

Oil and gas development within the NPR-A could introduce for the first time such infrastructure and activities into the winter range of a North Slope caribou herd (Teshekpuk Caribou Herd). Previously, no North Slope caribou herd has been exposed to oil gas activities year-round. The Teshekpuk Caribou Herd has experienced seismic exploration and activities near villages for many years, and some herd members on the periphery of the range have been exposed to oil field facilities in some years, but there is no evidence as yet of adverse effects other than increased hunting mortality for those animals close to villages. It is not known what population effects might occur if the majority of the herd were to have year-round contact with oil and gas facilities and activities. Despite the current lack of evidence regarding adverse effects from seismic exploration and village contact, negative effects on caribou energy budgets during winter could result from this new situation. Such an effect could be manifested through increased winter mortality itself, or a reduction in calf productivity.

Muskoxen – Muskoxen occur in low densities in the NPR-A, and they are not present year-round in all years in areas that might be developed under Alternative B-2. Potential effects of oil and gas development activities include displacement and disturbance of individual animals, direct habitat loss from gravel mining in river floodplains and at oil or gas field facilities, and indirect habitat loss through reduced access caused by physical or behavioral barriers created by roads, pipelines, and other facilities. Under Alternative B-2, impacts would be similar to or less than those under Alternative A, since the area around Teshekpuk Lake, where one mixed-sex group has been known to occur, would not be offered for lease.

Moose – Moose occur in low densities in the NPR-A during the summer and are concentrated in major drainages at the eastern edge of the NPR-A in the winter (Map 3.3.6-12). Unless oil or gas fields were developed in the eastern portion of the NPR-A along the Colville River, development would be unlikely to have more than a minor impact on moose. Under Alternative B-2, impacts to moose would be similar to those discussed under Alternative A, because the probability of a development in that portion of the NPR-A would be the same or similar.

If gravel were mined from the eastern portion of the NPR-A, a temporary displacement and disturbance of moose could occur. Borrow pit operations could potentially destroy or degrade up to 1,125 acres of moose habitat if all gravel borrow operations occurred in the eastern portion of the NPR-A (an unlikely scenario).

Dall Sheep – Dall sheep would not be affected by oil or gas activities under Alternative B-2 because the area along the extreme southern edge of the NPR-A where they may occur would not be available for oil or gas leasing.

Grizzly Bears – Major sources of noise include construction of roads, installation of crude oil or gas pipelines, pump or compressor stations, gravel mining, and drilling operations. These activities could disturb grizzly bears within a few miles of the noise sources. Industrial activities and human presence could also cause potentially serious disturbances to denning bears. Under Alternative B-2, impacts to grizzly bears would be similar to those that would occur under Alternative A, although the extent and duration of impacts could be less because of the smaller overall development scenario, depending on the locations of field development. Grizzly bears are present at low densities in the northern portion of the NPR-A, but could be attracted to some activities. It is likely that the greatest number of bears would be encountered during development activities in the central portion of the NPR-A, because the southern portion with the highest densities of bears would not be available for leasing under Alternative B-2.

Wolves – Under Alternative B-2, oil and gas development would have a similar impact on wolves as under Alternative A. Potential effects to wolves would include short-term disturbance from air and surface traffic and human presence, and increased hunting and trapping pressure through improved access or increased human presence associated with oil or gas development. If caribou abundance decreased substantially as a result of oil and gas development, wolf abundance could, in turn, decrease. However, wolves are not abundant in the portions of the NPR-A that would be available for leasing in Alternative B-2, with the possible exception of the Colville River.

Wolverines – The potential effects of oil and gas development on wolverines under Alternative B-2 are the same as under other alternatives, and could include disturbance from air and surface vehicle traffic, increased human presence, and habitat alteration. Because wolverines are considered a shy and secretive species, they could be sensitive to oil or gas exploration and development activities, and abandon habitat areas near development. If development affected caribou abundance, wolverines could be affected in turn. Alteration of riparian habitats through gravel excavation or pipeline construction could affect wolverines, especially during the winter when these habitats provide cover and important hunting areas. Wolverines are present at relatively low density in the portions of the NPR-A available for leasing, with the possible exception of the area along the Colville River, and sightings there have been infrequent. Documented sightings and harvest locations suggest that wolverines could be encountered just about anywhere in the areas available for leasing. Impacts under this alternative are likely to be similar to or slightly less than those that would occur under Alternative A, given the smaller overall development scenario.

Foxes – Under Alternative B-2, impacts to arctic and red foxes would be similar to those discussed under Alternative A, although they could be less in duration and extent. Oil and gas development activities could affect foxes by increasing the availability of food and shelter. An increase in the fox population associated with oil or gas development could affect some prey of foxes (such as ground-nesting birds and molting waterfowl) in the development area and over a region larger than the oil field itself (Burgess et al. 1993).

Effects of Abandonment and Reclamation

Abandonment and reclamation activities are expected to disturb and displace terrestrial mammals in a manner similar to that associated with construction. The intensity of the disturbance might be less than during construction, however, because it is possible that caribou, muskoxen, and other terrestrial mammals would have become habituated to road and air traffic over the course of construction and operation of the facilities. Some individuals could be killed by collisions with road traffic. If roads were left in place and maintained in useable condition upon abandonment, they could continue to provide improved access to hunting areas, with consequent hunting pressure on caribou and other subsistence species. Revegetation of roads, pads, and airstrips, if left in place, would facilitate reclamation of habitat, but plant communities on these raised gravel structures would likely be different from those that prevail in adjacent areas and may include invasive species. Pads, roads, and airstrips could provide some insect-relief habitat for caribou, if left in place (Murphy and Lawhead 2000). If gravel fill was removed and the pad revegetated with vegetation similar to the surrounding plant communities, caribou, and possibly other terrestrial mammals, would use the area. Foam insulating materials that could be used in pad construction could be broken up in the course of removal. If some of this foam escapes being cleaned up, it may be used by foxes as denning material. Depending on the material's toxicity and the amount ingested by a fox, this could cause mortality, though the numbers of foxes killed would likely be very small. Overall, a smaller amount of development is assumed under Alternative B-2 than under Alternative A, providing even less impacts from abandonment and reclamation. Those impacts would likely be expressed over a similar time period, resulting in no population-level effects from these activities in either case.

Effects of Spills and Gas Releases

Spills could involve crude oil, refined products, produced water, or seawater. Typical refined products that are spilled on the Alaska North Slope include aviation fuel, diesel fuel, engine oil, fuel oil, gasoline, grease, hydraulic oil, transformer oil, and transmission oil. The extent of environmental impacts would depend upon the type, location, and amount of materials spilled or released, and the effectiveness of the response. The majority of small spills would be contained on the gravel pad and would have no impact on terrestrial mammals or their habitat. Gas releases could occur at well sites (i.e., over a gravel or ice pad) or from pipelines, the great majority of which would be over tundra.

The impacts of oil spills and gas releases on terrestrial mammals are described under Alternative A (section 4.4.9, "Terrestrial Mammals" in Volume 2). Compared to Alternative A, the risk of oil spills would be less, but still small, under Alternative B-2, given the lower estimate of spills. A total of one large spill is still assumed, but the number of small spills assumed for Alternative B-2 is only 76 percent of that for Alternative A for both crude and refined oil spills. Assumed spill volume is also 24 percent less for both crude oil and refined oil spills. Since no oil or gas activities would occur in the vicinity of Teshekpuk Lake, the likelihood that a spill would reach the lake under Alternative B-2 is greatly reduced. Because most spills would be small and affect a small area, the majority of impacts to terrestrial mammals would result from disturbance associated with spill cleanup activities rather than direct oiling. The assumed number of gas releases (2.7 incidents = 0.9 incidents per 300 pipe miles times 897 miles of pipe), if ignited, would result in thermal effects to approximately 522 acres of tundra. If a wildfire resulted, additional acreage would burn, the amount depending on season, weather conditions, moisture content of vegetation, and suppression effort.

4.5.9.3 Effectiveness of Stipulations and Best Management Practices

The lease stipulations and best management practices developed to protect terrestrial mammals under Alternative B-2 are largely equivalent to the lease stipulations and required operating procedures designed to do the same under Alternatives A and B-1. As such, they will provide the same benefits. Notable exceptions to this are an addition to Best

Management Practice E-8 to encourage storage and reuse of overburden and sod at material sites or other disturbed sites; the addition of Best Management Practice E-19 to aid in monitoring and assessing wildlife movements during and after construction of infrastructure; an addition to Best Management Practice F-1 to extend the flight restrictions covering the Teshekpuk Lake Caribou Habitat area to the Utukok Uplands Special Area and to prevent the hazing of wildlife by aircraft; the addition of H-3 to minimize impacts to hunters and trappers; improved control of ground traffic in Lease Stipulation K-5; a setback of 1 mile rather than ¾ mile along the Kogru River in Lease Stipulation K-6; the addition of K-12 to minimize disturbances to Western Arctic Herd caribou in key summer habitats (absent from Alternative A but present in all other alternatives); and the addition of M-1 to prevent the chasing of wildlife with ground vehicles. In some cases where areas are unavailable for leasing under Alternative B-2 but are available under Alternative A, those stipulations and best management practices would be moot for Alternative B-2 except for off-lease activities to develop valid existing NPR-A oil and gas leases.

4.5.9.4 Conclusion

Under Alternative B-2, oil and gas leasing and exploration would be precluded in one large block surrounding Teshekpuk Lake and extending to the northwest just beyond the Dease Inlet, and another larger block in the southwestern portion of the NPR-A. In other portions of the NPR-A, lease stipulations and best management practices would provide seasonal and spatial protection to certain environmentally sensitive areas, including the Rivers Area, Deep Water Lakes, the Colville River Special Area and Coastal Area. The exposure of terrestrial mammals to oil and gas activities, and therefore, the level of associated impact, would be less under Alternative B-2 than under all other alternatives except Alternative B-1, given that leasing of lands surrounding Teshekpuk Lake could not occur and that the overall scale of development is assumed to be less under Alternative B-2.

Among the terrestrial mammal populations that could be affected by management actions under Alternative B-2 are the Teshekpuk Caribou Herd, Western Arctic Herd, and Central Arctic Herd caribou. Caribou could be exposed to helicopter traffic and other human activities associated with resource inventories, seismic operations, exploratory drilling, and pipeline construction. The Teshekpuk Caribou Herd caribou movements within some wintering areas could be disrupted by oil or gas exploration or development activities. Although much of the construction associated with oil and gas development would occur primarily during winter, development would bring year-round facilities and activities into some portions of caribou range where it has not existed in the past. If valid existing leases were developed in the area west of Nuiqsut, production pads, pipelines, within-field roads, and other facilities would be located within areas used by the Teshekpuk Caribou Herd for insect relief, migration, and wintering.

It is expected that impacts to terrestrial mammals in the vicinity of Teshekpuk Lake would be much less under Alternative B-2 than under Alternatives A, C or D, particularly with respect to caribou calving and insect-relief habitat. Overall, impacts throughout the NPR-A would be less under Alternative B-2 than under Alternatives A, C or D, given the smaller overall scale of the planned development, but slightly greater than for Alternative B-1. In general, impacts to mammals from non-oil and gas activities, and from oil and gas activities, would likely be additive, except possibly in those areas where both types of activities occurred simultaneously. Impacts to mammals from exploration and development activities would also be additive, as opposed to compensatory, except possibly for habitat impacts where development occurred in habitats previously disturbed during exploration. In areas where two or more activities occurred, overall impacts would reflect those impacts associated with the first activity and any new impacts associated with later activities.

The two large blocks that would be unavailable for leasing are important to Teshekpuk Caribou Herd and Western Arctic Herd caribou as calving and insect-relief areas, and in the case of the Teshekpuk Caribou Herd, wintering grounds. In addition, some stipulations and best management practices have been revised to provide further protection for caribou and terrestrial mammals and their habitat in general. Based on the amount of habitat with a potential to be directly affected by actual development footprint, the magnitude of impacts to mammals under this alternative would be about 15 percent less than Alternative A. If oil and gas activities occurred in areas with an abundance of caribou or other mammals, or in areas with high-quality habitat, impacts could be greater than those based strictly on number of acres of habitat impacted.

There will be impacts to terrestrial mammals from climate change (section 3.3.6.8 in Volume 1) and from the oil and gas activities expected under Alternative B-2. Whether the combination of impacts from these two sources is additive or compensatory, or synergistic or countervailing, will depend on where and how development and climate change actually play out in the NPR-A. Climate change could make foraging more difficult for herbivores during winter, possibly causing negative, synergistic effects to mammals when combined with disturbance and displacement of mammals by oil and gas activities. Geographic shifts in the vegetation communities of the NPR-A as a result of climate change could have synergistic impacts to mammals if they resulted in a greater proportion of higher quality habitat for any season overlapping with areas of concentrated oil and gas activity. Alternatively, these vegetation community shifts could move important habitat out of the areas affected by oil and gas activity, resulting in a countervailing effect. Climate change may increase the availability of suitable habitat for some species (e.g., shrub habitat for moose) but may reduce suitable habitat for other species. For any terrestrial mammals affected in the latter way, it is likely that adverse impacts of climate change will be additive to any adverse effects of oil and gas activities, and the two combined may have synergistic adverse effects.

4.5.10 Marine Mammals

4.5.10.1 Activities Not Associated with Oil and Gas Exploration and Development

Baleen Whales

Effects of activities not associated with oil and gas exploration and development would be similar to Alternatives A and B-1. There is a possibility of increased recreational activities in the Special Areas, but no direct effects to gray whales or minke whales are expected.

Toothed Whales

As with Alternatives A and B-1, the impacts of activities within the NPR-A, but not related to oil and gas exploration and development, would include air traffic; aerial surveys to inventory wildlife or other resources; summer research camps; hazardous material or debris removal; and recreational camps and boating activity. The level of non-oil and gas activities would probably not differ between Alternatives A, B-1, and B-2, thus the effects on beluga whales, narwhals, harbor porpoise, and killer whales would not differ.

Ice Seals

Effects of activities not associated with oil and gas exploration and development would be similar to Alternatives A and B-1. There could be increased recreational activities in the Special Areas, although no direct effects to spotted or ribbon seals are expected.

4.5.10.2 Oil and Gas Exploration and Development Activities

Baleen Whales

Effects to large whales from oil and gas exploration under Alternative B-2 would likely be less than under Alternative A, but similar to Alternative B-1. The amount of NPR-A land made available for leasing is 11.8 million acres under Alternative B-2 compared to 11 million acres under Alternative B-1. In Alternative B-2, the area unavailable for leasing in the Arctic Coastal Plain east of Barrow is largely the same as under Alternative B-1, except that lands in the northeastern NPR-A near Fish Creek are made available for leasing and lands between Barrow and Dease Inlet/Admiralty Bay are unavailable. The coastal regions made available in the northeastern NPR-A near Fish Creek would, however, be subject to the 1-mile setback provisions of Stipulation K-6. Like Alternative B-1, Kasegaluk Lagoon, Wainwright Inlet/Kuk River, and Peard Bay, and their associated barrier islands within NPR-A, would be unavailable for leasing, as would lands within 1 mile of Peard Bay and Kasegaluk Lagoon. Special Areas created under Alternative B-2 are similar to those under Alternative B-1, although the inland, terrestrial portions of the Peard Bay and Kasegaluk Lagoon Special Areas are removed. The marine portions of these two Special Areas are the same as under Alternatives B-1 and C, so would provide similar levels of protection to marine mammals. The combined acreage for inclusion in the five Special Areas proposed under Alternative B-2 is less than under Alternative B-1, but greatly exceeds that proposed under Alternatives A, C, or D. Stipulation K-6 under Alternative B-2 provides additional protection to coastal waters—and marine mammals—by precluding exploratory or production well drill pads, or oil or gas processing facilities in coastal waters or within 1 mile of the coast (as compared to 0.75 mile for most areas under Alternatives B-1 and C). The amount of land being made unavailable for oil and gas leasing along coastal areas suggests that there could be fewer industry-related flights over these coastal waters and less noise imparted to the marine environment than under Alternative A. Industry-related traffic associated with potential new non-subsistence infrastructure along many of these areas otherwise unavailable for leasing could result in a higher level of noise than under Alternative B-1.

Seismic Activities

Effects from onshore seismic surveys would be similar to Alternatives A and B-1 and are not expected to affect cetaceans. Unavailability of most of the coastline east of Barrow and much to the west would further reduce any noise from seismic testing to enter marine waters.

Shipping

Effects from shipping under Alternative B-2 may be similar to Alternative B-1. The protected marine areas could result in fewer nearshore barge transits in those areas and less noise produced in adjacent marine waters than under Alternatives A, C, and D. Dease Inlet/Admiralty Bay, Kasegaluk Lagoon, Wainwright Inlet/Kuk River, and Peard Bay are unavailable for leasing and exploration, but new non-subsistence infrastructure would be allowed. This could include infrastructure associated with offshore development in the Chukchi or Beaufort seas, which could, ultimately, be associated with some level of vessel traffic transiting between offshore leases and onshore infrastructure. Gray whales do react to approaching large vessels in some circumstances (Moore and Clarke 2002), and little is known about the effects of shipping on minke whales. Large whales are not known to use the Peard Bay and Kasegaluk Lagoon Special Areas. Ship/whale collisions are expected to be relatively rare.

Toothed Whales

Oil and gas exploration, development, and transport activities within the NPR-A could impact beluga whales, harbor porpoises, narwhals, and killer whales in a manner similar to Alternative B-1. Disturbances would most likely be from anthropogenic sounds, ship strikes, or habitat degradation. Sound would be produced by vessels and aircraft, seismic operations, construction of facilities close to the coast, or exploration, production, and transport of oil or gas. Vessels supporting activities in the NPR-A could strike whales and porpoises, causing injury or death.

Under Alternative B-2, the area unavailable for leasing in the Arctic Coastal Plain east of Barrow is similar to Alternative B-1, except that lands in the northeastern NPR-A near Fish Creek are made available for leasing and lands between Barrow and Dease Inlet/Admiralty Bay are made unavailable. Lands in the eastern NPR-A near Fish Creek would, however, be subject to the 1-mile coastal setback required under Stipulation K-6. As with Alternative B-1, Kasegaluk Lagoon, Wainwright Inlet/Kuk River, and Peard Bay, and their associated barrier islands within NPR-A, would be unavailable for leasing, as would lands within 1 mile of Peard Bay and Kasegaluk Lagoon. Special Areas created under Alternative B-2 are similar to those under Alternative B-1, except for the reduced size of the terrestrial portions of the Peard Bay Special Area and Kasegaluk Lagoon Special Area. The marine portions of these two Special Areas are the same as under Alternatives B-1 and C, so would provide similar levels of protection to marine mammals. The combined acreage of the five Special Areas proposed under Alternative B-2 is less than under Alternative B-1, but greatly exceeds that proposed under Alternatives A, C, or D. Although Dease Inlet/Admiralty Bay, Kasegaluk Lagoon, Wainwright Inlet/Kuk River, and Peard Bay are unavailable for leasing, new non-subsistence infrastructure would be allowed. This could include infrastructure associated with offshore development in the Chukchi or Beaufort seas. Provisions listed in Stipulation K-3b establish criteria for mitigating infrastructure development and use in these named water bodies. In addition, Stipulation K-6 under Alternative B-2 precludes exploratory or production well drill pads, and oil or gas processing facilities in coastal waters and within 1 mile of the coast (as compared to 0.75 miles for most areas under Alternatives B-1 and C). These provisions, along with the acreage included in Special Areas and unavailable to leasing, would reduce impacts, compared to Alternative A, to belugas, narwhals, harbor porpoises, and killer whales. This is especially relevant to beluga whales that annually congregate in and near Kasegaluk Lagoon.

Overall impacts from oil and gas activities in Alternative B-2 would likely be minimal and less than impacts from activities specified in Alternative A. Although land included in Special Areas is smaller than under Alternative B-1 and coastal lands made available to new non-subsistence infrastructure is greater, required protective measures under Alternative B-2 should ensure that impacts to toothed whales would be minimal.

Ice Seals

Types of potential direct and indirect effects on spotted and ribbon seals from activities authorized under Alternative B-2 do not differ from those described under Alternatives A or B-1. Oil and gas-related effects, however, would likely be more limited than those disclosed under Alternative A, and similar to Alternative B-1. Alternative B-2 does not allow leasing in the Kogru River, Elson Lagoon, Dease Inlet, Admiralty Bay, Wainwright Inlet/Kuk River, Peard Bay, Kasegaluk Lagoon, associated islands, and lands within 1 mile of Peard Bay and Kasegaluk Lagoon (Map 2-2). Unlike Alternative B-1, new non-subsistence infrastructure, which could include that associated with offshore development in the Chukchi or Beaufort seas, could be permitted in these areas. Provisions listed in Stipulation K-3b establish criteria for mitigating infrastructure development and use in these named water bodies. Unavailability to leasing would preclude the possibility of production oil spills directly into these important marine waters, and would protect spotted and ribbon seals from most other direct impacts as well. The larger river setbacks required in the K-1 Stipulation under Alternatives B-1 and B-2 further mitigate the possibility of an onshore oil spill entering river systems and, ultimately, reaching marine waters. Provisions of Stipulation K-6 provide coastal habitat protection that includes the entirety of the Kasegaluk Lagoon and Peard Bay Special Areas, and a setback requirement of one mile along the coastal regions. Both species would still be sensitive to refined oil spills and discharge related to shipping traffic in support of onshore activities. Aggregations of spotted seals are afforded additional protections from potential impacts from aircraft flights (Best Management Practice F-1) and marine traffic (Stipulation K-6) near terrestrial haulouts under Alternative B-2 than is provided by the other Alternatives.

4.5.10.3 Effectiveness of Stipulations and Best Management Practices

Baleen Whales

The effectiveness of stipulations and best management practices would be similar to that of the stipulations and required operating procedures in Alternatives A and B-1, with a few exceptions. Stipulation K-1 includes larger setbacks along several rivers under Alternatives B-1 and B-2, which could more effectively decrease chances of an onshore spill reaching marine waters. Stipulation K-3b sets criteria for how pipelines and other permissible infrastructure associated with offshore development could occur in several coastal areas unavailable for leasing yet available for non-subsistence infrastructure. Stipulation K-6 provides additional protection to coastal waters –and marine mammals-- by precluding exploratory or production well drill pads, and oil or gas processing facilities in coastal waters and within 1 mile of the coast (compared to 0.75 mile for most areas under Alternatives B-1 and C).

Toothed Whales

The stipulations and best management practices, as they relate to marine mammals for Alternative B-2 are similar to the required operating procedures and stipulations in Alternative A and B-1. One notable exception is Stipulation K-3b. In Alternative B-1, this stipulation expands the protection for coastal areas. Stipulation K-3 under Alternative A protects Elson Lagoon/Dease Inlet/Admiralty Bay, whereas Alternative B-1 and B-2 also protect Peard Bay, Kasegaluk Lagoon, and Wainwright Inlet/Kuk River. Under Alternative B-2, these areas would be unavailable for leasing, but would be available for new non-subsistence infrastructure. For the latter, this stipulation would apply to infrastructure associated with offshore development in the Chukchi and Beaufort seas and set criteria for how this could occur. This could enhance protection of beluga whales and other marine mammals that congregate in these areas, including in Kasegaluk Lagoon. . Stipulation K-1 includes larger setbacks along several rivers under Alternatives B-1 and B-2, which could more effectively decrease chances of an onshore spill reaching marine waters via down-river transport. Stipulation K-6 also provides additional protection to coastal waters by precluding exploratory or production well drill pads, or oil or gas processing facilities in coastal waters or within 1 mile of the coast (compared to 0.75 miles for most areas under Alternatives B-1 and C) and for the entirety of Kasegaluk Lagoon and Peard Bay Special Areas. This is particularly relevant to beluga whales that congregate annually in Kasegaluk Lagoon.

Ice Seals

The stipulations and best management practices of Alternative B-2, as they relate to ice seals, are similar to the required operating procedures and stipulations in Alternatives A and B-1. Notable exceptions are Stipulations K-1, K-3b, K-8b, K-6, and Best Management Practices C-1 and F-1. In Alternatives B-1 and B-2, Stipulation K-1 would more effectively minimize the chance that an onshore oil spill would reach marine waters through down-river transport by including twice as many rivers as are named in Alternative A and by requiring larger setbacks for several of the named rivers. Under Alternative B-1, Stipulation K-3b expands the protection for coastal areas by adding more major coastal waterbodies in its provisions: the Kogru River, Peard Bay, Kasegaluk Lagoon, and Wainwright Inlet/Kuk River. Since these waterbodies are not available for leasing under Alternative B-2, only the section pertaining to development and infrastructure apply. Stipulation K-8b, although applicable to Alternative B-1, does not apply to Alternative B-2, since permanent oil and gas infrastructure would be allowed. Provisions in Stipulation K-6 add additional layers of protection and mitigation for seals in coastal areas, particularly Kasegaluk Lagoon and Peard Bay, with an increased setback requirement of 1 mile. Specific to Alternative B-2, is a requirement for marine vessels participating in a BLM-authorized activity to maintain a 1-mile buffer from shore when passing seal aggregations. This is particularly relevant for spotted seals. Also unique to Alternative B-2, Best Management Practice F-1 includes a minimum altitude requirement and buffer zone around seal aggregations during BLM-authorized aircraft flights. Stipulations and provisions for these areas are expected to be effective at minimizing impacts to spotted and ribbon seals located there. In addition, seals would be adequately protected within Special Areas, such as Kasegaluk Lagoon where marine mammals are specifically listed as a main value to protect. Although discharge from support vessels may not be effectively regulated through the A-series Best Management Practices, and could result in impacts to both species, under Alternative B-2 requirement b of Stipulation K-6 would prohibit marine vessels from transferring ballast or discharging any matter into the marine environment within 3 miles of shore.

Conclusion

Baleen Whales

Under Alternative B-2, most impacts will remain associated with marine shipping and barging. Most of the impacts on gray and minke whales would be disturbances related to marine noise, but ship/whale collisions are a possibility. Population-level effects are unlikely.

Toothed Whales

Impacts to belugas, narwhals, harbor porpoises, and killer whales under Alternative B-2 would likely be short-term and local, and would be less than those under Alternative A due to the increased amount of land assigned Special Area status and made unavailable for leasing; overall impacts may be similar to Alternative B-1. The most likely impact would be displacement from preferred habitats or disturbance to normal behavior due to anthropogenic sounds mostly from activities not associated with oil and gas. These impacts would likely be localized and temporary and not incur population-level changes.

Ice Seals

Under Alternative B-2, the greatest effect to spotted seals from non-oil and gas-related activities will likely be in the form of haulout disturbance by aircraft and marine vessel traffic. Provisions of Stipulation K-6 and Best Management Practice F-1 should alleviate much of the potential disturbance to aggregations of seals. Effects, if they occur, will likely be short-term and of the same magnitude as presented in Alternatives A and B-1. Ribbon seals are unlikely to be affected by non-oil and gas activities due to their pelagic nature. Types of impacts to spotted seals from oil and gas activities will be similar to non-oil and gas activities, but will also include the chance of an accidental large or very large contaminant spill, and higher potential for the introduction of pathogens from increased marine vessel traffic. Relative to Alternative A, the potential for impacts from oil and gas activities is greatly decreased due to an increase in special areas and lands made unavailable for leasing, and changes in and additions to several stipulations and best management practices. The level of protection afforded seals under Alternative B-2 may be slightly less than under B-1, since more land is available for leasing, several coastal areas unavailable to new non-subsistence infrastructure under Alternative B-1 are available for such under Alternative B-2, and some of the coastal area included in the Peard Bay Special Area under Alternative B-1 is not included under Alternative B-2. Provisions included in Stipulation K-6, in particular, should, however, mitigate potential impacts to these coastal habitats. Impacts cannot be accurately predicted and large numbers of spotted seals could potentially be affected if perturbations occur at major haulouts where seals congregate during the open-water season. Due to their absence from the nearshore area, ribbon seals are only likely to experience adverse effects from an accidental very large contaminant spill that is not effectively cleaned near the source, or the introduction of new pathogens to the system. Alternative B-2 would limit the potential for development activities to negatively impact seals in and adjacent to the NPR-A planning area more than would Alternatives A, C, and D.

Climate change effects, such as sea-ice loss, could affect the susceptibility of ice-seals to impacts from development. How these species will react to predicted changes in sea-ice conditions is unknown at this time. Spotted seals have the capacity to adapt by using other haulout substrates such as terrestrial areas. Such a change however, would put them at greater risk from both non-oil and oil and gas activity disturbance onshore. Ribbon seals, which are a pelagic species and primarily dependent on seasonal sea ice for molting and whelping, may be less vulnerable to the combined effects of sea-ice changes and oil and gas development activities. The mechanisms by which effects of climate change and anthropogenic activities interact are unknown and could range from synergistic to countervailing.

4.5.11 Special Status Species

The following discussion of impacts is divided into four sections that discuss special status species of plants, birds, terrestrial mammals, and marine mammals.

Within each subsection, authors describe impacts of non-oil and gas activities and oil and gas activities and the effectiveness of stipulations and best management practices and then provide a conclusion (where the discussion is long enough to warrant one).

4.5.11.1 Special Status Species of Plants

Nine plant species listed as BLM Sensitive Species and their habitats are described in section 3.3.8 in Volume 1. All of these have been found within the outer boundaries of the NPR-A. An additional 12 species designated as sensitive by BLM-Alaska have been documented on the North Slope, but have not yet been documented in the NPR-A. The types of impacts to these plant species are the same as those for all other vegetation. These impacts are described in section 4.5.5 and are not repeated here.

Under Alternative B-2, development would be unlikely to affect any plant species' existence or any plant communities at scales larger than local effects. However, if development facilities were constructed in an area containing a population of a BLM Sensitive plant species (by definition rare), the impacts to that population, and thus the species, could be severe. However, this potential would be greatly reduced by the implementation of BMP M-3, which requires surveys for sensitive species prior to development. Some of the habitats potentially occupied by sensitive species would be protected from development under Alternative B-2 by setbacks along rivers and lakes. Other species occur in dry habitats associated with bluffs, floodplains, river terraces, sand dunes, rocky outcrops, and fellfields. These habitats are the primary sources of gravel fill used during construction and development (National Research Council 2003) and could be impacted by development in these areas.

4.5.11.2 Special Status Species of Birds

This section discusses the potential direct and indirect effects to threatened, endangered, and sensitive bird species that could result from management actions in the NPR-A under Alternative B-2. This includes yellow-billed loon, spectacled eider, Steller's eider, Kittlitz's murrelet, red knot, short-eared owl and golden eagle (collectively referred to as special status species below). All of these species are migratory and do not occur in the NPR-A during winter.

Most of the activities that could potentially affect these special status birds in the NPR-A would result from oil and gas exploration, development and transport.

Other activities that could potentially affect birds include permitted recreation, guided hunting, activities associated with scientific surveys and research camps, cleanup of oil and gas exploration sites, and activities associated with government actions (e.g., cleanup of abandoned well sites). These activities could affect tundra-nesting special status birds by causing: (1) habitat loss; (2) disturbance or displacement; (3) increased predation; and (4) direct mortality. Impacts would most often be localized and on the scale of individual birds.

Alternative B-2 would make available 52 percent (11.8 million acres) of the NPR-A for oil and gas leasing, although leasing in lands currently deferred from leasing until 2014 (see Alternative A) would not be offered for lease, until the expiration of the deferral while the 2018 deferral would not be offered for leasing even after the of expiration of the deferrals (see Map 2-2). Approximately 11 million acres would be unavailable for leasing and five special areas containing 13.35 million acres would be allocated. Management practices would emphasize performance-based stipulations and best management practices on surface activities, consultation with local residents, and coordinated scientific studies to protect wildlife habitat, subsistence use areas, threatened eiders species and other resources.

Activities Not Associated with Oil and Gas Development and Exploration

Under Alternative B-2, activities not related to oil and gas exploration and development that could affect special status species in the NPR-A would be the same as those described under Alternative A: air traffic; aerial surveys to inventory wildlife or other resources; summer research activities; hazardous material or debris evaluation and presence and removal; and permitted recreational camps and boating activity. As compared to Alternative A, impacts to eiders from non-oil and gas activities could be less frequent, lesser in extent, or shorter in duration under Alternative B-2. Fewer individual animals likely would be exposed to human activities as protective best management practices and large areas in which lands are unavailable for oil and gas leasing and areas where new non-subsistence infrastructure would be prohibited from large areas important to some special status species and because the lesser amount of oil and gas activity projected in this alternative may reduce the amount of non-oil and gas activity by reducing the impetus for scientific studies. Aircraft traffic would less often pass overhead of special status species during flights to or from the camps and along aerial survey routes. Impacts would generally be localized, and the disturbance reactions of special status species would likely be brief. Some special status species might avoid scientific and recreation camps during the 6 to 12 weeks of activities, while their predators (e.g., ravens) could be attracted to the camps as protective best management practices and large areas in which lands are unavailable for oil and gas leasing and areas where new non-subsistence permanent infrastructure is prohibited protect birds and their habitats and would help to mitigate the potential effects of non-oil and gas activities on special status species under Alternative B-2.

Oil and Gas Exploration and Development Activities

Exploration

Ground-based seismic surveys to collect geological data and exploration activities occur during the winter months when special status species are absent from the NPR-A. Therefore, these activities would likely have no direct impacts on these species. Although the same number of seismic surveys is estimated to take place under both Alternatives A and B-2, under Alternative B-2 the indirect impacts to the eiders and yellow-billed loon associated with winter exploration would be less than those under the other alternatives as many areas of high value to these species would be unavailable for leasing and a large amount would not allow new non-subsistence infrastructure, therefore, exploration activities in those areas are unlikely to occur.

Alternative B-2 prohibits exploration activities in the same areas and manner as Alternative A (i.e., in Dease Inlet, Admiralty Bay, Elson Lagoon, and associated islands). However, unlike Alternative A, it adds other high-quality bird habitats to the prohibition. These include Kasegaluk Lagoon, Wainwright Inlet/Kuk River, and Peard Bay, and their associated barrier islands within NPR-A, would be unavailable for leasing, in addition to the named and unnamed bays, lagoons, and other coastal waters within the NPR-A boundary east of Barrow. In the case of Peard Bay and Kasegaluk Lagoon, lands within 1 mile of those two waterbodies would be unavailable for leasing. These areas are very important to many special status species during critical life stages such as migration staging, molting, and breeding, and therefore, special status species would benefit greatly from the protection. During winter, when exploration activities would be allowed (but no special status species are present), indirect impacts could result from the construction of ice roads and ice pads, and the associated water withdrawal. The types of effects that could result from the construction and use of ice roads and ice pads would be the same under Alternative B-2 as those described under Alternative A, and would primarily involve the temporary alteration of tundra habitats. Water withdrawal for ice road construction could also temporarily alter habitats adjacent to water source lakes, which could affect nesting or brood-rearing loons and eiders. However, a smaller area would be available to oil and gas exploration activities under Alternative B-2, as compared to any of the other alternatives. Therefore, the potential impacts to special status species resulting from exploratory activities would likely be less under Alternative B-2 than under any of the other alternatives.

Alternative B-2 contains the same measures as all other alternatives to avoid human-caused increases in predator populations. This includes Required Operating Procedure/Best Management Practice A-2 and Stipulation E-9, which would minimize the availability of anthropogenic food (e.g., garbage) and shelter, respectively that could be utilized by predators. Similarly, measures addressing proper handling of hazardous materials associated with the drilling process and accidental spills are the same among all alternatives as well (i.e., Required Operating Procedures/Best Management Practices A-1 through A-7). Therefore, Alternative B-2 offers no advantage or disadvantage to special status birds from the handling of waste products.

Under Alternative B-2, oil and gas exploration wells would create an estimated combined short-term ground disturbance of 456 acres, and a long-term ground disturbance of less than 1 acre. Delineation wells would impact the same number of acres, although not necessarily in the same locations as the exploration wells. This is the least amount of short-term bird habitat loss predicted for any alternative, with about 20 percent less than the next lowest alternative (Alternative B-1) and 45 percent less than Alternative A. There is essentially no (less than 1 acre) long-term habitat loss predicted from exploration activities in any alternative.

Development and Production

Under Alternative B-2, these types of development and production activities would be the same as those discussed under Alternative A. In order to mitigate the potential negative effects to special status bird species from activities associated with the oil and gas development and production activities Alternative B-2 includes a large number of applicable stipulations and best management practices, some of the most important are: Stipulations E-2, F-1e, G-1, K-2, K-3 b, K-6, and Best Management Practices A-2a and b, B-2, E-9, E-10, E-11, E-18, K-4a, K-8b. Stipulations K-4a and K-6 in Alternative B-2 offer greater protection to birds than do the corresponding stipulations in Alternative A. However, because the amount and location of activities could be different under Alternative B-2, effects to the special status birds could also vary, as discussed in detail below.

Habitat Loss. Of all activities, gravel mining and placement for the construction of oil and gas field infrastructure would have the greatest potential to result in the permanent loss of habitat for short-eared owl, yellow-billed loon, and spectacled and Steller's eiders. Under Alternative B-2, it is estimated that a total of 530 acres would be disturbed for central processing facilities and gas compressor facilities (see Table 4-14 in Volume 2). In conjunction with these facilities, other support structures would also be needed, such as gravel production pads, runways, and roads. Under Alternative B-2, the gravel footprint (total long-term disturbance) would be 8,402 acres (see Table 4-14 in Volume 2). If spectacled and Steller's eider densities are assumed to be 2.2 and 0.02 birds per square mile (640 acres per square mile) respectively (very high estimates based on aerial survey data; Larned et al. 2006; Ritchie and King 2003), up to 13 spectacled eiders and 0.1 Steller's eider could be expected to be displaced by the gravel footprint over the life of the plan if all development occurred in high-density areas. This is likely a high estimate because areas of "high" eider density make up only a relatively small proportion of the NPR-A (Map 3-33). Of all the alternatives, Alternative B-2 is predicted to create the second lowest amount of long-term surface disturbance, with about 10 percent more surface disturbance than Alternative B-1 and about 20 percent less than Alternative A.

In addition to permanent habitat loss, temporary loss of tundra habitat adjacent to gravel roads and pads could occur as a result of thermokarst, dust deposition, snow accumulation, water withdrawals (if recharge does not occur) and impoundment formation. Under Alternative B-2, the types of effects to special status species resulting from temporary habitat loss would be the same as those discussed under Alternative A. However, the loss would likely be less under Alternative B-2 than any other alternative except Alternative B-1, because of the larger area unavailable for leasing, the resultant reduced need for infrastructure, and the protections imposed on some areas that contain large numbers of yellow-billed loon and spectacled eiders. The extent of effects to special status species from temporary habitat loss would depend on the number of individuals occurring in areas within and adjacent to the development.

Mortality to special status species could result from collisions with vehicles (ground and air), structures such as elevated pipelines, buildings, drilling rigs, towers, power lines if suspended, boats (including barges), or bridges. Any species of bird may be vulnerable to collision under certain circumstances (see Alternative A); in fact, it is one of the few ways that golden eagle, short-eared owl, Kittlitz's murrelet, or red knot could potentially be impacted under any alternative. The potential for collisions by any special status bird species would be lower in Alternative B-2 than any other alternative except for Alternative B-1 due to the larger area unavailable for leasing and the resultant reduced need for infrastructure. However, mortality from collisions would be minor under any alternative. All of the special status species would likely be impacted at the level of the individual and not at a population level.

Disturbance. The potential for disturbance to special status birds from ground-based travel on roads, within pads, and cross-tundra would likely be less under Alternative B-2 than any other alternative. This is because of the larger area unavailable for leasing (including a large tract of important spectacled eider habitat east of Dease Inlet and around Teshekpuk Lake and a large tract of Steller's eider habitat west of Dease Inlet), and the resultant reduced need for pads, pipelines, roads, and associated infrastructure. In addition, this alternative would enlarge Special Areas and create one new Special Area. Potential impacts from summer cross-country travel on tundra would be limited in Alternative B-2 the same as all other alternatives, and would only be allowed on a case-by-case basis, and only after extensive studies have been conducted (Required Operating Procedure/Best Management Practice L-1).

Aircraft, both fixed-wing and helicopter, would provide access for oil and gas-related activities throughout the development, operation, and abandonment of any oil or gas field developed in the NPR-A. The types of disturbance effects to special status species from aircraft would be the same under Alternative B-2 as those discussed under Alternative A, and could include displacement from preferred feeding habitats, temporary or permanent nest abandonment, and temporary or permanent displacement from staging, molting, or brood-rearing areas. Aircraft disturbance would likely be lowest in Alternative B-1, second in Alternative B-2, with the greatest level of disturbance likely to occur in Alternatives C and D.

The types of disturbance effects to special status species from watercraft would be the same under Alternative B-2 as those discussed under Alternative A, and could include displacement from preferred habitats and nest abandonment. As the expected number of sealifts in Alternative B-2 would be lower than in the other alternatives except for Alternative B-1, the impacts from yellow-billed loon and eider collisions with barges would also be lower in Alternative B-2.

Oil-spill-response training activities using watercraft could be conducted on rivers and lakes several times during the summer. The potential for disturbance to some special status species from these activities would likely be less under Alternative B-2 than any other alternative except for Alternative B-1, because of the larger amount of area unavailable for leasing, the resultant reduced need for infrastructure, and the protections imposed on some areas that contain large numbers of yellow-billed loons and eiders. The extent of effects to yellow-billed loons and eiders from oil spill and gas release response activities would depend on the number of individuals occurring in areas within and adjacent to the impacted area.

Predation. Some predators, such as raven, gulls, arctic fox, and bear could be attracted to areas of human activity where anthropogenic sources of food and denning or nesting sites were present. The potential impacts of increased numbers of predators on eiders are discussed under Alternative A. Increased predation pressure could have moderate impacts on any of the special status species. Under Alternative B-2, there would be less potential for increased predation than under the other alternatives except for Alternative B-1, as there would be less human activity and anthropogenic sources of food available.

Abandonment and Reclamation

Development scenarios indicate that at abandonment of the field, gravel pads and roads may or may not be removed and that reclaimed or abandoned pads may be revegetated by native vegetation or would be allowed to bed naturally. Given that scenario, it is very difficult to determine potential effects to special status species from these unknown activities. For this document, it is assumed that all gravel will be removed after abandonment. Given that assumption, the impacts of abandonment and reclamation of oil and gas fields on eiders would be similar in many respects to those incurred by construction activity. The types of activities would be the same for Alternative B-2 as described in Alternative A. However, Alternative B-2 would likely have less impact than the other alternatives except for Alternative B-1, as less total area would be available for oil and gas development, resulting in less total area to be abandoned and subsequently rehabilitated.

Oil Spills and Gas Releases

Under Alternative B-2, the types of effects to special status species resulting from oil and seawater spills and gas releases would be the same as those discussed under Alternative A.

Although the estimated large spill volume is the same for all alternatives, the probability of a spill occurring is notably less under Alternative B-2 (30 percent chance) than under Alternatives A, C, and D (37, 37, and 39 percent chance, respectively) and slightly higher than under Alternative B-1 (28 percent). This difference is due to the greater size of the lands unavailable for oil and gas leasing within areas of high potential for oil discovery in Alternative B-2 compared to all alternatives except for Alternative B-1, thus reducing the anticipated oil recovery. Even with the protection of particularly sensitive areas (e.g., coastal shoreline), and the substantial emphasis on spill prevention and response, if a large crude oil spill occurred, it could have a measurable effect to most of the special status species at a population level. Exceptions to this would be the species whose range only peripherally includes the NPR-A or adjacent marine waters, such as golden eagle, red knot, and Kittlitz's murrelets, or those not associated with water (e.g., golden eagle and short-eared owl). Effects to individual birds that make contact with oil or oiled forage could range from short-term disturbance to death. This applies to all of the special status species regardless of how uncommon they are; in fact, this is one of the few ways that red knot, Kittlitz's murrelet, or golden eagle could potentially be impacted by any alternative. Impacts to special status species (especially yellow-billed loon and eiders) on a population level could occur if oil from a large spill entered rivers, important molting or brood-rearing lakes, or marine areas during periods when large proportions of those species are present. Many factors would determine the probability and extent to which birds would be negatively impacted by a large oil spill, including the quantity spilled, season, location (e.g., land versus water), and proximity to sensitive habitat. Oil entering a river or stream could potentially spread into delta or coastal areas, where impacts could be more severe to staging or molting yellow-billed loons and spectacled or Steller's eiders. An oil spill in coastal zone and nearshore habitats of the Colville River Delta, Harrison Bay, Smith Bay, Dease Inlet, Elson Lagoon, or Kasegaluk Lagoon, which support large congregations of threatened eider species, could affect large numbers of individual birds. Under all alternatives, the potential that an oil spill would enter a major river or stream would be minimized by Stipulation K-1. This stipulation would provide setbacks from specified rivers, within which permanent oil and gas facilities would be prohibited, although pipelines may be allowed in some of these areas.

Oil spilled (from a barge or support vessel) into marine habitats would have the potential to spread oil over a larger area than in terrestrial habitats due to winds and currents; therefore, birds found in marine habitats within NPR-A could be particularly susceptible to the negative impacts of an oil spill. The reduced need for marine transportation under Alternative B-2 relative to Alternatives A, C, and D would reduce the opportunity for a spill to occur compared to those alternatives. For further discussion of potential effects of marine spills, see Alternative A.

A gas release from a well is expected to last one day and to release 10 thousand cubic feet of gas while a release from a transmission pipeline or processing facility is estimated to release 20 thousand cubic feet over a few hours. Although the estimated release volume is the same for all alternatives, the difference in the estimated number of gas production wells and lengths of various pipelines would change the probability of a release between the alternatives. The potential for disturbance to special status species from a gas release would likely be less under Alternative B-2, as compared to all other alternatives except for Alternative B-1, because of the larger area unavailable for leasing, the resultant reduced need for infrastructure, and the protections imposed on some areas that may contain large numbers of special status species.

Effectiveness of Stipulations and Best Management Practices

The central theme of Alternative B-2 is the designation of large areas of the NPR-A as unavailable to oil and gas leasing, prohibition of new non-subsistence infrastructure within some of the unavailable to leasing areas, the creation and expansion of special areas, and the protection of marine habitat and shorelines important for marine animals, waterfowl, and shorebirds. These unavailable lands and designated areas of special importance result in the protection of many natural resources including special status species (especially spectacled and Steller's eiders) and their habitats.

Alternative B-2 would make approximately 11 million acres of the NPR-A unavailable for oil and gas leasing. About one quarter of this land is in the northeast area of the NPR-A and it includes, among other values, important spectacled eider nesting and brood-rearing habitat and supersedes the current time-limited (2018) deferral north and east of Teshekpuk Lake. Other lands would be unavailable for leasing in Alternative B-2 to protect marine habitats, shorelines, and nesting habitat. This includes areas important for spring and fall staging and migration of spectacled and Steller's eiders (Elson Lagoon, Dease Inlet, Admiralty Bay, Wainwright Inlet/Kuk River, Peard Bay, and Kasegaluk Lagoon, and their associated barrier islands and, in the case of Peard Bay and Kasegaluk Lagoon, lands within 1 mile of those two waterbodies), Steller's eider nesting habitat west of Dease Inlet, and spectacled eider nesting habitat both east and west of Dease Inlet and north and east of Teshekpuk Lake.

Alternative B-2 would enlarge two existing special areas and create one new special area (see section 2.3.2 in Volume 1). The Teshekpuk Lake Special Area would be expanded and 86 percent of this special area is unavailable to oil and gas leasing in order to better protect, among other values, spectacled and Steller's eider nesting and brood-rearing habitats. Alternative B-2 would also create a Peard Bay Special Area to protect, among other values, habitat for yellow-billed loon and eider staging and migration. All alternatives including Alternative B-2 contain numerous stipulations and best management practices to effectively protect special status species and their habitats within the NPR-A. These include Best Management Practices A-1 and A-2, which address the proper storage, handling, and disposal of solid, liquid, and hazardous wastes (including fuels), as well as Best Management Practices s A-3 through A-7, which address hazardous material releases and oil spills through prevention, storage, handling, and disposal. The protection of special status birds, their habitats, and food sources are addressed by Best Management Practices B-1, B-2, C-2, C-3, C-4, D-2, E-9, E-12, E-18, Protection J, and Stipulations E-2 and L-1, among others. Protection J would help minimize the take of species listed under the Endangered Species Act, as would Best Management Practices E-11 and E-18, which contain specific language aimed at reducing impacts to spectacled and Steller's eiders, including their nests and brood-rearing areas. A series of stipulations, including K-3, K-4, and K-8, provide additional protections in biologically sensitive areas and many of these provide protections to eider habitats and food sources. The "A" best management practices provide provisions that require disposal of garbage and other waste materials in a manner that will avoid attracting wildlife to the area and reduce the potential for human-caused increases in predator populations. The "B" best management practices would help limit the impact of water withdrawals on lakes, or lake habitats, used by eiders, while the "C" best management practices govern seismic ground operations to prevent seismic activity-related disturbance to eiders and provide protection for over-wintering invertebrates which are sources of food for eiders. Alternative B-2 makes 86 percent of the Teshekpuk Lake Special Area unavailable for leasing, and 27 percent would prohibit new non-subsistence infrastructure This would restrict the total area that can be developed within areas that are used in high density by nesting Steller's and spectacled eiders. In addition, there are numerous best management practices and stipulations that would protect some special status species and their habitats by regulating the types of activities that can occur near waterbodies, including rivers and streams, types of equipment that can be used, and types of exploration and development activities that can be conducted in the planning area.

Finally, Alternative B-2 provides stipulations and best management practices along with making lands unavailable for leasing and areas where new non-subsistence infrastructure is prohibited that provide protection to surface resources that is superior to the other alternatives. As there has been no oil or gas development yet in the NPR-A, it is difficult to determine the effectiveness of the above-mentioned best management practices and stipulations. Best management practices and stipulations that have been in effect in the

NPR-A to date regulate exploratory activities, and thus far, seem to be effective in protecting special status species and their habitats.

Conclusion

Alternative B-2 emphasizes the protection of surface resources more than any other alternative except for Alternative B-1, and would be most favorable for special status species. It would designate the second highest acreage of lands unavailable to oil and gas leasing much of which purposefully includes very high-value bird habitats, especially for Steller's and spectacled eider. It makes approximately 11.8 million acres of federally owned subsurface (52 percent of the total in the NPR-A) available for oil and gas leasing (Map 2-2-2) and approximately 11 million acres of the NPR-A unavailable for oil and gas leasing. Approximately 3.1 million acres between Atigaru Point (and waters within NPR-A near the point) in the east to Ukpeaġvik Iñupiat Corporation (Barrow village corporation) lands on the west would be unavailable for leasing this area encompasses and supersedes the current time-limited (2018) deferral for lands north and east of Teshekpuk Lake. Of the lands currently deferred from leasing, some in northwestern NPR-A would be made available for leasing after expiration of the deferrals described in Alternative A. Other currently deferred lands would not become available because, under this alternative, they would be unavailable for leasing. While this plan makes no decisions regarding a corridor for infrastructure associated with offshore development in the Chukchi or Beaufort seas, such a corridor could be accommodated in this alternative, subject to appropriate conditions developed through a NEPA process. This infrastructure would not be allowed on lands where new non-subsistence permanent infrastructure is prohibited, but no other provision of this alternative would directly or indirectly prohibit infrastructure in support of offshore development in the Chukchi or Beaufort seas.

Alternative B-2 would enlarge two existing Special Areas and create one new Special Area. Special Area designation does not itself impose specific protections, but instead highlights areas and resources for which BLM will extend "maximum protection" consistent with exploration of the Reserve. Alternative B-2 would add approximately 1.9 million acres to the Teshekpuk Lake Special Area, which would provide enhanced protection for Yellow-billed loons, eiders and red knot breeding, molting, staging, and migration habitats. The 1.6-million-acre Peard Bay Special Area would be created with an explicit purpose of protecting nearshore waters for waterbirds. Spectacled eiders and yellow-billed loons use this area during spring and fall. Yellow-billed loons, eiders and red knot would also benefit from the addition to Teshekpuk Lake Special Area.

Non-oil and gas activities that could potentially affect special status species would be the same as those in Alternative A. Under all alternatives, this analysis shows that impacts to special status species from non-oil and gas activities would be minor.

A lower overall level of development would likely occur under Alternative B-2, as compared to all other alternatives except for Alternative B-1. The potential for habitat loss and alteration to affect birds would be less under Alternative B-2, as compared all other alternatives except Alternative B-1, and the amount of high-value bird habitat that would be lost to gravel infrastructure would be much less than in Alternatives A, C, and D. The potential for mortality resulting from collisions with vehicles or infrastructure and marine vessel traffic would be less under Alternative B-2, because the amount of infrastructure and barge traffic would be less than in the other alternatives. The potential for an oil spill to impact special status birds would also be less under Alternative B-2, as compared to the other alternatives, given the reduced need for infrastructure and development activity and the protections afforded to coastal areas and other important habitats. Stipulations and best management practices established under Alternative B-2 would help to mitigate potential impacts to eiders, yellow-billed loons, and other special status bird species.

Under Alternative B-2, the types of disturbances related to vehicle, aircraft, pedestrian, and vessel traffic, routine maintenance activities, heavy equipment use, facility noise, and oil spill and gas release cleanup activities would be similar to those described under Alternative A. The potential for these disturbances to impact special status birds would be much less under Alternative B-2, as a large portion of the high-use bird habitat is unavailable for leasing.

Stipulations and best management practices established under Alternative B-2 would help to mitigate potential impacts to special status species. Effectiveness of stipulations and best management practices is unknown at this time, but they are presumed to be effective.

In general, impacts to special status species from non-oil and gas activities, and from oil and gas exploration and development activities, would be additive. Potential impacts from seismic activity would vary by alternative with Alternatives A and B-2 each expecting to require five exploratory and six developmental seismic surveys, although Alternative B-2 is expected to require greater area coverage by seismic survey than does Alternative A so the total area impacted in Alternative B-2 will be larger than that in Alternative A (see Table 4-11 in Volume 2). This larger area of potential seismic activity would likely avoid many high value bird habitats as many of those areas are unavailable for leasing in this alternative. Alternatives C and D are estimated to require 14 and 16 total seismic surveys, respectively, which will cover a greater area than would be needed in Alternative B-2. The expected number of oil and gas fields and the level of development under Alternative B-2 would be lower than under all of the other alternatives except for Alternative B-1. Therefore, it is expected that the potential effects of disturbance, habitat loss and alteration, and eider mortality due to development under Alternative B-2 would be lower that under any of the other alternatives with the exception of Alternative B-1 presented in this plan. All alternatives would minimize unintentional take of migratory birds and conserve migratory bird populations. The special status species susceptible to the greatest amount and types of impacts include those that regularly breed on NPR-A's tundra, where most activities would occur (i.e., Steller's eider, spectacled eider, yellow-billed loon, and short-eared owl). The remaining species (golden eagle, red knot, and Kittlitz's murrelet) would be infrequently exposed to activities, and would be susceptible primarily just to collisions and oil spills. In the absence of a large oil spill, none of the special status species would be expected to incur population-level effects from full implementation of Alternative B-2.

Although many of the forces driving global climate regime shifts may originate outside the Arctic, the impacts of global climate change are exacerbated in the Arctic (Arctic Climate Impact Assessment 2004). Temperatures in the Arctic have risen faster than in other areas of the world, as evidenced by glacial retreat and melting sea ice. Special status species whose range in Alaska is concentrated in the Arctic may be the most vulnerable to the effects of a changing climate. These species include yellow-billed loon, spectacled and

Steller's eiders, and red knot. Effects to these special status species from climate warming may include a suite of effects, both positive and negative. A longer open-water season may increase productivity of some species of shorebirds and increase productivity in aquatic and semi-aquatic systems, which provide food for yellow-billed loon and spectacled and Steller's eider.

Warmer soil temperatures are likely to increase thermokarst, and increases in sea level may inundate low-lying tundra areas, increasing salt marsh, aquatic and wet tundra vegetation types, and erosion of coastal bluffs (Arctic Climate Impact Assessment 2004) causing changes in coastal habitats that may quickly result in changes in vegetation that influence habitat suitability and availability for spectacled and Steller's eiders (Mars and Houseknecht 2007). The increasing thickness of the active layer of soil above arctic permafrost is likely to cause changes in moisture regimes and the distribution of vegetation types over much of the Arctic in coming years. Drying of wetlands would result in negative effects to spectacled and Steller's eiders that rely on shallow water and wet meadows, and shrub expansion may reduce the quality and availability of some types of habitats. Such impacts could accelerate or exacerbate changes in soil thermal regimes that occur with development, potentially leading to greater impacts to special status species habitat. Increase in human economic activities such as shipping and offshore oil and gas development may influence the abundance and distribution of predators, which may negatively affect special status species populations. These changes may be beneficial to some special status species such as those associated with boreal forest or shrub habitats (golden eagle), but a reduction in the amount of tundra habitat available could negatively impact spectacled and Steller's eiders, red knot, and short-eared owl and add to the cumulative effects of oil and gas development. High rates of coastal erosion and storm surges have led to saltwater intrusion into freshwater habitats and such intrusions may alter foraging and brood-rearing habitats for spectacled and Steller's eiders.

4.5.11.3 Special Status Species of Terrestrial Mammals

Two species of terrestrial mammals listed as BLM Sensitive Species are described in section 3.3.8 in Volume 1. Neither of these has been found within the NPR-A in recent decades. The Alaskan hare has not been reported on the North Slope since 1951, and the Alaska tiny shrew has never been documented in the NPR-A. The types of impacts to these two mammalian species would be the same as those for all other terrestrial mammals. These impacts are described in section 4.4.9 in Volume 2 and are repeated here only briefly.

Under Alternative B-2, development would be unlikely to affect either of these two species, primarily because it is unlikely that either exists in the NPR-A. This is especially so for the Alaskan hare, since if this relatively large-bodied species occurred in the NPR-A, it would most likely have been documented one or more times in the last 60 years. It is more likely that the Alaska tiny shrew has occurred or does occur in the NPR-A without having been documented. If development facilities were constructed in an area containing a population of Alaska tiny shrew, adverse impacts to that population could occur. These impacts would most likely be manifested in the loss of habitat, and could also involve the deaths of some individuals if they were to be run over by heavy equipment during construction of development facilities. This potential would be greatly reduced, however, by the implementation of BMP M-4, which would require surveys for shrews prior to development.

4.5.11.4 Special Status Species of Marine Mammals

Activities Not Associated with Oil and Gas Development and Exploration

Baleen Whales

Effects of activities not associated with oil and gas exploration and development on bowhead, fin, and humpback whales would be similar to Alternatives A and B-1.

Ice Seals

Aircraft and vessel traffic are the non-oil and gas activities most likely to have a direct impact on ringed and bearded seals. The potential effects of these activities are described under Alternative A. Impacts from activities not associated with oil and gas exploration and development would not differ from Alternative A or B-1. Non-oil and gas related impacts would be negligible.

Polar Bear

Winter overland travel is the non-oil and gas activity likely to have the most effect on polar bears in the planning area. Potential impacts to polar bears from this and other activities are described in Alternative A. No difference in the potential to impact polar bears, nor in the level of impact, would be expected between Alternatives A and B-2.

Pacific Walrus

Potential impacts from non-oil and gas activities would be similar to those discussed under Alternative A. The non-oil and gas activities with the most potential to impact walruses in the planning area are noise and visual disturbances from aircraft, vessels, and land-based traffic. No difference in the potential to impact walruses, nor in the level of impact, would be expected between Alternatives A and B-2.

Oil and Gas Exploration and Development Activities

Baleen Whales

Effects to large whales from oil and gas exploration under Alternative B-2 would likely be less than under Alternative A, but similar to Alternative B-1. Under Alternative B-2, the area unavailable for leasing in the Arctic Coastal Plain east of Barrow is similar to Alternative B-1, except that lands in the northeastern NPR-A near Fish Creek are made available for leasing and lands between Barrow and Dease Inlet/Admiralty Bay are made unavailable. The coastal regions made available near Fish Creek would, however, be subject to the 1-mile setback provisions of Stipulation K-6. Like Alternative B-1, all marine waters including Kasegaluk Lagoon, Wainwright Inlet/Kuk River, and Peard Bay, and their associated barrier islands within NPR-A, would be unavailable for leasing, as would lands within 1 mile of Peard Bay and Kasegaluk Lagoon. Special Areas created under Alternative B-2 are similar to those under Alternative B-1, although the sizes of the terrestrial portions of Peard Bay and Kasegaluk Lagoon Special Areas are smaller. The marine portions of these two Special Areas are the same as under Alternatives B-1 and C, so would provide similar levels of protection to marine mammals. The combined acreage for inclusion in the five Special Areas proposed under Alternative B-2 is less than under Alternative B-1, but greatly exceeds that proposed under Alternatives A, C, or D. Stipulation K-6 under Alternative B-2 provides additional protection to coastal waters—and marine mammals—by precluding exploratory or production well drill pads, or oil or gas processing facilities in coastal waters or within 1 mile of the coast (as compared to 0.75 mile for most areas under Alternatives B-1 and C). The amount of land being made unavailable for oil and gas leasing along coastal areas suggests that there could be fewer industry-related flights over these coastal waters and less noise imparted to the marine environment than under Alternative A. Industry-related traffic associated with potential new non-subsistence infrastructure along many of these areas otherwise unavailable for leasing could, however, result in a higher level of noise and disturbance effects than under Alternative B-1.

Seismic Activities. Effects from onshore seismic surveys would be similar to Alternatives A and B-1, and are not expected to affect bowhead, fin, or humpback whales. The unavailability of a large portion of the coastline for leasing and coastal setback requirements would further reduce noise transmission from onshore seismic testing into marine waters.

Shipping. Effects from shipping under Alternative B-2 may be similar to Alternative B-1. The protected marine areas could result in fewer nearshore barge transits in those areas and less noise produced in adjacent marine waters than under Alternatives A, C, and D. Dease Inlet/Admiralty Bay, Kasegaluk Lagoon, Wainwright Inlet/Kuk River, and Peard Bay are unavailable for leasing and exploration, but new non-subsistence infrastructure would be allowed. This could include infrastructure associated with offshore development in the Chukchi or Beaufort seas, which could, ultimately, be associated with some level of vessel traffic transiting between offshore leases and onshore infrastructure. Large whales are not known to use the Peard Bay and Kasegaluk Lagoon Special Areas. Ship/whale collisions are expected to be relatively rare.

Ice Seals

Types of potential direct and indirect effects on ringed and bearded seals from oil and gas activities authorized under Alternative B-2 do not differ from those described under Alternatives A or B-1. Oil and gas-related effects, however, would likely be more limited than those disclosed under Alternative A, and similar to Alternative B-1. Alternative B-2 does not allow leasing in the Kogru River, Elson Lagoon, Dease Inlet, Admiralty Bay, Wainwright Inlet/Kuk River, Peard Bay, Kasegaluk Lagoon, associated islands, and lands within 1 mile of Peard Bay and Kasegaluk Lagoon (Map 2-2). Unlike Alternative B-1, new non-subsistence infrastructure, which could include that associated with offshore development in the Chukchi or Beaufort seas, could be permitted in these areas. Provisions listed in Stipulation K-3b establish criteria for mitigating infrastructure development and use in these named water bodies. Unavailability to leasing would preclude the possibility of production oil spills directly into these important marine waters, and would protect spotted and ribbon seals from most other direct impacts as well. The larger river setbacks required in the K-1 Stipulation under Alternatives B-1 and B-2 further mitigate the possibility of an onshore oil spill entering river systems and, ultimately, reaching marine waters. Provisions of Stipulation K-6 provide coastal habitat protection that includes the entirety of the Kasegaluk Lagoon and Peard Bay Special Areas, and a set-back requirement of one mile along coastal regions of the NPR-A. Ringed and bearded seals would still be sensitive to refined oil spills and discharge related to shipping traffic in support of onshore activities.

Aggregations of seals are afforded additional protections from potential impacts from aircraft flights through Best Management Practice F-1 and from marine traffic near terrestrial haulouts through Stipulation K-6 under Alternative B2. The latter stipulation is particularly relevant for non-status spotted seals, as they are the ice seal species most likely to aggregate on land, but all ice seal species could benefit.

Polar Bear

Seismic Activities. Less overall disturbance to polar bears from seismic surveys would be expected under Alternative B-2 than under Alternative A. Seismic surveys conducted within approximately 5 miles of the coast could expose undetected denning polar bears to noise and associated disturbances, resulting in the displacement of maternal polar bears and their dependent cubs, abandonment of the den, and possible death of polar bear cubs. Best Management Practice C-1 would prohibit cross-country use of heavy equipment and seismic activities within one mile of known polar bear dens and require operators to consult with the U.S. Fish and Wildlife Service before initiating activities in coastal habitat between October 30 and April 15. Depending on the suitability of the area for polar bear dens, operators may also be required to survey for dens prior to seismic activities. This combination of procedures minimizes the chance that denning polar bears would be disturbed by seismic activities. Impacts to individual female polar bears and cubs would only occur in the unlikely instance that a den would go undetected during a survey. No population-level impacts are anticipated.

Exploration. Areas unavailable for leasing under Alternative B-2 would include the Kasegaluk Lagoon and Peard Bay Special Areas, coastal waterbodies and their islands, and nearly the entire coastline of an enlarged Teshekpuk Lake Special Area. Alternative B-2 would provide additional protection for polar bear denning and barrier island critical habitat (as shown on Map 3.3.8-6) between Dease Inlet and Barrow by making these lands unavailable for leasing, an area in which Alternative B-1 would allow leasing. In areas available for leasing under Alternative B-2, it is estimated there could be up to 40 oil exploration and delineation wells and 112 gas exploration and delineation wells. These wells are expected to be drilled from ice pads, causing short-term ground disturbance of 240 and 672 acres, respectively. The actual number of exploratory wells with potential to affect polar bears is not currently known; but only those wells drilled within 25 miles of the coast would have the potential to directly affect polar bears, and only those within 5 miles of the coast would have the potential to affect denning polar bears.

Exploratory drilling near the coast during winter (December to mid-April) would potentially disturb, displace, or attract polar bears. As described under Alternative A, the primary threat to polar bears would be disturbance to females in maternal dens and attraction of non-denning bears to support facilities.

Conservation measures have been established to protect female polar bears denning within 1 mile of construction activity. Best Management Practice C-1 would require all industrial activities maintain a one-mile buffer around known or suspected polar bear dens. In addition, oil and gas exploration activities within polar bear habitat would require coordination by the operator with the U.S. Fish and Wildlife Service to locate any potential polar bear dens prior to winter exploration activities.

Lease stipulations and Best Management Practices A-1 and A-2, which would require proper waste prevention, handling, and disposal, should be effective in preventing or minimizing attraction of polar bears. Best Management Practice A-8, requiring implementation of a bear-interaction plan, would reduce the likelihood of negative human-bear encounters. These plans include measures to minimize attraction of bears to industrial facilities, methods for communicating to workers about bears in the area, and an outline of proper procedures to follow in the event that bears are observed near industrial facilities and work sites. Lessees would be required to keep a systematic record of bears on site and in the immediate area, which could be used to inform future stipulations and policies intended to minimize human-bear conflicts. Such requirements for facility management and human-bear interaction plans have been successfully implemented at oil and gas exploration and production facilities in other portions of the North Slope. It is anticipated that impacts to polar bears attracted to exploration activities in the planning area would also be minimized and actively managed to promote human safety, while limiting detrimental effects to the bears. Other lease stipulations under Alternative B-2 directly protect important year round coastal habitats of polar bears. And under Alternative B-2, lease stipulation K-6 restricts exploratory activities within one mile of the entire NPR-A coastline, protecting summer and winter shoreline habitat for polar bears.

Development and Production. Under Alternative B-2, less coastal area would be open for oil and gas leasing than under Alternative A. Surface disturbances would include gravel production pads and central processing facilities for oil and gas, gravel roads, gravel runways, and several types of pipelines (some of which may be buried). Under Alternative B-2, the long-term disturbance footprint would be 8,402 acres. The actual number of development and production facilities (and associated acreage) with potential to affect polar bears is unknown at present. Only facilities within 25 miles of the coast would be likely to directly affect polar bears, and facilities within 5 miles of the coast could affect maternal dens.

Impacts to polar bears, including disturbance caused by development and production activities, would likely be less under Alternative B-2 than those described for Alternative A because more coastal areas would be unavailable for oil and gas leasing while this IAP/EIS is in effect.

The same avoidance and mitigation measures that would be employed during exploration would be utilized during development and production, including avoiding denning polar bears by one mile, minimizing polar bear attraction to facilities, developing human-bear interaction plans, and implementing training for facility personnel. Additionally, Best Management Practice E-5 would require that facilities be designed to minimize impacts of the development footprint, while Best Management Practice E-4 would require sound pipeline construction to minimize leaks; these practices help minimize take of listed species.

Oil Spills and Gas Releases. Alternative B-2, like Alternative A, poses some risk of small and large spills of oil, refined fuel, and produced water and some potential for gas releases. These events could happen at any time of the year, and polar bears could come into contact with unrecovered oil on land, on ice, or at sea. The results to the physical health of the bear would be the same regardless of location.

The impacts of oil spills and gas releases on polar bears are described in detail under Alternative A. Direct oiling could lead to hypothermia and result in increased energy costs or death. Oiled polar bears would ingest oil by grooming, and polar bears could also ingest oil by eating oiled seals or carcasses. Ingested crude oil is highly toxic to polar bears (Oritsland et al. 1981; Stirling 1990). Exposure to oil or associated fumes could cause respiratory distress and inflammation of mucous membranes and eyes, leading to abrasions and ulcerations. Even partial oiling of a polar bear is likely to result in mortality, while chronic low levels of exposure could result in sublethal effects that reduce fitness.

Compared to Alternative A, the risk of oil spills under Alternative B-2 would be less, given the lower estimate of spills. The number of small spills assumed for Alternative B-2 is about 76 percent of that for Alternative A for both crude and refined oil. Although the likelihood of an individual bear coming into contact with a small spill is very low, polar bears could avoid coastal areas that were fouled by oil or be displaced by response activities, which could result in impacts to fitness, breeding success, or survival. Alternative B-2 has a smaller risk of exposing polar bears to small spills than Alternative A. Effects of a small spill would be short-term (days to weeks), localized, and would likely involve low numbers of individuals.

The risk of large spills for each alternative is based on the volume of oil expected to be produced over the life of the oil exploration and development that might proceed from leasing and discoveries in the NPR-A. The percent chance of one large spill occurring is 30 percent under Alternative B-2. The risk of a large spill is lower under Alternative B-2 than under Alternatives A, C, or D. The potential impacts to polar bears resulting from a large oil spill are discussed in Alternative A. Under any of the alternatives, the extent of impacts from a large oil spill would depend on the size, location, and timing of spills relative to polar bear distributions and on the effectiveness of spill response and cleanup. A population-level effect might occur if a spill were to contact an aggregation of polar bears, which do occur in the vicinity of beached whale carcasses. However, polar bears are typically widely dispersed, so it is more likely small numbers of individual polar bears would be directly affected through oiling in the event of a large spill. However, even a few individuals removed from the threatened populations of polar bears could be significant to the recovery of the local population, particularly if females or females with cubs were oiled. Response activities associated with a large spill also have the potential to disturb or affect polar bears; displace them from feeding, resting and denning areas; and potentially contaminate their food chain.

As stated under Alternative A, there is a small potential that a large gas release could occur from a platform, pipeline, or onshore facility. Direct impacts to polar bears would be minimal because gas would quickly dissipate. Although a bear in the immediate vicinity could potentially experience impacts from inhaling gas, or be injured or killed if an explosion occurred with the release, these scenarios are unlikely. Impacts to polar bears may occur as a result of response activities. If disturbance caused polar bears to be excluded from feeding, resting, or denning areas, this could impact body condition, breeding success, or survival.

Effects of Abandonment and Reclamation. Effects of abandonment and reclamation would generally be similar to those under construction (in both the exploration and development and production stages). Human activities, particularly visual and noise components, could disturb individual polar bears, including both denning and non-denning bears. Disturbing known denning polar bears would be avoided as during construction activities. No population-level effect would be expected.

Pacific Walrus

The types of potential impacts to Pacific walrus from oil and gas exploration and development activities would be similar to those discussed under Alternative A. The oil and gas activities that have the most potential to impact walrus in the planning area are oil spills and noise and visual disturbances from aircraft, vessels, and land-based activities. Of particular concern is disturbance to walrus using coastal haulouts, especially when no sea ice is available as a resting platform. Under Alternative B-2, direct impacts to walrus from oil and gas activities would be unlikely because of the relatively restricted areas of the Chukchi Sea coast that would be available for oil and gas exploration and development. Objectives of the Peard Bay Special Area and the Kasegaluk Lagoon Special Area include protecting marine mammal habitats and preventing contamination of marine waters. Under Alternative B-2, no leasing would be allowed in Kasegaluk Lagoon Special Area or Peard Bay Special, and there would be special restrictions on facility development in coastal waters within NPR-A and within one mile of the entire NPR-A coastline. This alternative would prohibit any oil drilling pad or central processing facility within BLM-managed coastal waters or within one mile of the coast, but it does not preclude other facilities necessary for oil and gas development within the NPR-A, when it is necessary that they be located along the coast. A pipeline from offshore oil or gas development could be accommodated. This alternative also does not preclude development of infrastructure associated with offshore oil and gas exploration and production or construction, renovation, or replacement of facilities on existing gravel sites within these special areas. These protections would benefit walrus by placing some restrictions on oil and gas development in the vicinity of several known walrus haulout areas on the NPR-A Chukchi Sea coast, as well as providing additional protection for their nearshore feeding areas.

Effectiveness of Stipulations and Best Management Procedures

Baleen Whales

The effectiveness of stipulations and best management practices would be similar to that of the stipulations, required operating procedures, and best management practices in Alternatives A and B-1, with a few exceptions. Stipulation K-1 includes larger setbacks along several rivers under Alternatives B-1 and B-2, which could more effectively decrease chances of an onshore spill reaching marine waters. Stipulation K-3b sets criteria for how pipelines and other permissible infrastructure associated with offshore development could occur in several coastal areas unavailable for leasing yet available for non-subsistence infrastructure. Stipulation K-6 under Alternative B-2 provides additional protection to coastal waters by precluding exploratory or production well drill pads, and oil or gas processing facilities in coastal waters and within 1 mile of the coast (compared to 0.75 mile for most areas under Alternatives B-1 and C). Under Alternative B-2, Best Management Practice H-1 requires barge operators to demonstrate that barge activities will not have unmitigable adverse impacts on the availability of marine mammals to subsistence hunters. Although the intent of this is to mitigate disturbance to subsistence hunts, such as the fall bowhead whale hunt, it would also mitigate disturbance effects to subsistence resources, including bowhead whales.

Ice Seals

The stipulations and best management practices of Alternative B-2, as they relate to ice seals, are similar to the required operating procedures, best management practices, and stipulations in Alternatives A and B-1. Notable exceptions are Stipulations K-1, K-3b, K-8b, K-6, and Best Management Practice C-1 and F-1. In Alternatives B-1 and B-2, Stipulation K-1 would more effectively minimize the chance that an onshore oil spill would reach marine waters through down-river transport by including twice as many rivers as are named in Alternative A and by requiring larger setbacks for several of the named rivers. Under Alternative B-1, Stipulation K-3b expands the protection for coastal areas by adding more major coastal waterbodies in its provisions: the Kogru River, Peard Bay, Kasegaluk Lagoon, and Wainwright Inlet/Kuk River. Since these water bodies are not available for leasing under Alternative B-2, only the section pertaining to development and infrastructure apply. Stipulation K-8b, although applicable to Alternative B-1, does not apply to Alternative B-2, since permanent oil and gas infrastructure would be allowed. Provisions in Stipulation K-6 add additional layers of protection and mitigation to seals in coastal areas, including the entirety of the Kasegaluk Lagoon and Peard Bay Special Areas, with a 1 mile set-back along coastal regions of the NPR-A. Specific to Alternative B-2, is a requirement under this stipulation for marine vessels participating in a BLM-authorized activity to maintain a 1 mile buffer from shore when passing seal aggregations. Also unique to Alternative B-2, Best Management Practice F-1 includes a minimum altitude requirement and buffer zone around seal aggregations during BLM-authorized aircraft flights. Stipulations and provisions for these areas are expected to minimize impacts to ringed and bearded seals within these areas. In addition, seals would be adequately protected within Special Areas, such as Kasegaluk Lagoon where marine mammals are specifically listed as a main value to protect. Although discharge from support vessels may not be effectively regulated through the A-series Best Management Practices, and could result in impacts to both species, requirement b of Stipulation K-6 would, under Alternative B-2, prohibit marine vessels from transferring ballast or discharging any matter into the marine environment within 3 miles of shore. Stipulations would not protect ringed and bearded seals against large spills from marine traffic associated with development activities. Best Management Practice C-1 is made more effective in this alternative than in Alternative A, due to the explicit requirement for operators to conduct a survey to detect (and then avoid) seal birthing lairs for activities during the seal pupping season (through April 15). Ringed seal pups will be adequately protected only if lairs are identified.

Polar Bear

Many of the lease stipulations and best management practices in Alternative B-2 would provide protection to polar bears and their habitats within the planning area. Best Management Practices A-1 through A-8 would ensure that solid, liquid, and hazardous wastes do not attract polar bears or degrade their habitat. They would also require a public safety plan that includes bear-interaction plans to avoid or minimize many potential human-bear conflicts. Best Management Practice C-1 would prohibit seismic activities and the use of heavy equipment within 1 mile of known polar bear dens and would require lessees to comply with requirements under the Marine Mammal Protection Act. Best Management Practice E-5 would require that facilities be designed to minimize impacts of the development footprint, while Best Management Practice E-4 would require sound pipeline construction to minimize leaks; these practices would help minimize take of listed species. Best Management Practice I-1 would require orientation programs for oil and gas personnel, informing them of the importance of not disturbing biological resources, including endangered species and marine mammals. Protective measure J indicates the BLM would not approve any activity that may affect a listed species, until it completes its obligations under applicable requirements of the Endangered Species Act. Best management practices and Lease Stipulations K-1, K-3, K-4, K-6, and K-8 through K-11 would confer benefits to polar bears. These stipulations would: (1) limit activities along the banks of rivers and some lakes, reducing sources of disturbance in potential denning habitat; (2) limit activities in coastal habitats, reducing the potential for sources of disturbance and obstructions in this polar bear movement corridor; and (3) require year-round spill response capability during periods of broken ice or open water in certain inlets, bays, lagoons, and barrier islands important to polar bears.

Pacific Walrus

The measures that offer the greatest protection for Pacific walrus are provisions of Alternative B-2 and Stipulation K-6 that would result in no leasing and no new permanent non-subsistence infrastructure in certain areas important to this species, as described in section 4.3.11.4, "Special Status Species of Marine Mammals" in Volume 2. Additionally, under Alternative B-2 only, Best Management Practice F-1 would require that aircraft maintain minimum altitudes and a buffer zone near walrus haulouts, and Best Management Practice K-6 would require a shoreline buffer when marine vessels transit past an aggregation of walrus using a terrestrial haulout. Best Management Practice I-1 would require lessees to implement a program to inform personnel about the importance of not disturbing biological resources, including marine mammals. This required operating procedure should minimize direct disturbance to walrus from human activities.

Conclusion

Baleen Whales

Under Alternative B-2, most impacts to bowhead, fin, and humpback whales would be associated with marine shipping and barging, similar to Alternatives A and B-1. With most the coastline east of Barrow and much to its west unavailable to oil and gas leasing under Alternative B-2, there would be fewer industry-related flights over these waterbodies, less noise imparted to the marine environment, and less potential for contamination or spills associated with development and production than under Alternative A. However, much of the coastal area unavailable for leasing, with the exception of the Teshekpuk Lake region, would be available to new non-subsistence infrastructure. This could include infrastructure associated with offshore oil and gas development in the Chukchi or Beaufort seas. Most potential impacts would be disturbances related to marine noise, but there is a possibility of ship/whale collisions.

Population-level effects are unlikely. Fewer impacts to special status baleen whale species are anticipated under Alternative B-2 than under Alternatives A, C, or D.

Ice Seals

Similar to Alternatives A and B-1, non-oil and gas-related activities will likely have negligible impacts to ringed and bearded seal populations under Alternative B-2. The most likely impact could be haulout disturbance by aircraft, but this should be negligible due to relatively low numbers of flights and the benign nature of seal response. Provisions of Stipulation K-6 and Best Management Practice F-1 could further alleviate disturbance to aggregations of seals. Types of impacts to bearded and ringed seals from oil and gas activities would be similar to non-oil and gas activities, but could also include the chance of an accidental large or very large contaminant spill, and greater potential for introducing pathogens associated with increased marine vessel traffic. Disturbance of ringed seal pupping lairs is of concern during winter months, but ringed seal pups should be adequately protected if lairs are surveyed and avoided as directed by Best Management Practice C-1. Relative to Alternative A, the potential for impacts from oil and gas activities is greatly decreased under Alternative B-2 through an increase in special areas and lands made unavailable for leasing, plus changes in and additions to several Stipulations and Best Management Practices. This includes protections for Kasegaluk Lagoon, Peard Bay, Admiralty Bay, and other important habitats used for resting and pupping, particularly for ringed seals. The level of protection afforded seals under Alternative B-2 may be slightly less than under B-1, since more land is available for leasing and several coastal areas unavailable to new non-subsistence infrastructure under Alternative B-1 are available for such under Alternative B-2. Provisions included in Stipulation K-6, in particular, should, however, mitigate potential impacts to these coastal habitats. Alternative B-2 would limit the potential for development activities to negatively impact seals in and adjacent to the NPR-A planning area more than would Alternatives A, C, and D.

Climate change effects of habitat loss through diminished sea-ice extent and concentration could have increased adverse effects for these species when coupled with development. Ice-dependent species, such as ringed and bearded seals, may be more susceptible to effects of oil and gas activities due to the added stresses associated with these changes in sea-ice habitat. How either species will adapt to predicted changes in sea ice and snow conditions is currently under debate. Ringed seals have the greatest potential for negative effects through the loss of ice substrate for hauling out during critical energetic periods and lower quality pupping areas. Bearded seals are most likely to be impacted by sea ice loss through reduced availability of ice upon which to haul out for resting or pupping, reduced access to and reductions in prey resources throughout their range from oceanographic changes associated with sea ice loss that favor more pelagic seal species (Cameron et al. 2010). The mechanisms by which effects of climate change and anthropogenic activities interact are unknown and could range from synergistic to countervailing. The combined effects of climate change and development activities should be reduced under Alternative B-2 compared to Alternatives A, C, or D.

Polar Bear

Alternative B-2 would make approximately 11.8 million acres (about 52 percent) of the NPR-A available for oil and gas leasing. Under Alternative B-2, the new Peard Bay Special Area, the Kasegaluk Lagoon Special Area, and nearly all of the Teshekpuk Lake Special Area would be unavailable for new leasing, although a pipeline associated with offshore developments could be accommodated in each of them. Coastal area lease stipulations would protect coastal waters for marine mammals and restrict facility development in coastal waters and within one mile of the coast. It is expected that under Alternative B-2, the potential effects of disturbance, habitat loss and alteration, and potential mortality due to development would be lower for polar bears than that under Alternatives A, C, and D, but slightly higher than under Alternative B-1.

Non-oil and gas activities would be highly localized (e.g., worksites or camps) and/or transient (e.g., surveys and inventories). While non-oil and gas activities may result in disturbance to individual polar bears and may prevent some polar bears from using small portions of habitat temporarily, the activities are not anticipated to have long-term impacts to individual polar bears or measurable impacts at the population level. Consultations with U.S. Fish and Wildlife Service under the Endangered Species Act will address potential impacts associated with permitted non-oil and gas activities. Oil and gas activities may likewise result in disturbance to individual polar bears and may prevent some polar bears from using small portions of their habitat temporarily. Endangered species consultations will address those oil and gas activities that could affect polar bears and their critical habitat. Population-level impacts are, therefore, not expected as a result of oil and gas activities, with the exception of a large oil spill. Under some scenarios, a large oil spill could result in population-level effects or long-term impacts to the food chain. The likelihood of such an event is lower under Alternative B-2 than under the other alternatives, except for Alternative B-1.

The primary concern for the Southern Beaufort Sea and Chukchi/Bering Sea polar bear populations, portions of which use the NPR-A, is loss of sea ice. The U.S. Fish and Wildlife Service and U.S. Geological Survey have predicted that without changes in the rate of sea ice loss, the polar bear may no longer occur in much of its range in the next 40 to 75 years (see section 3.3.8), although Amstrup et al. (2010) suggest that mitigation of greenhouse gas emissions would improve polar bear persistence. With the exception of the chance for significant impacts to polar bears from oil spills, potential impacts to polar bears are low under Alternative B-2 because it provides for protection of marine mammals and their habitat along the Chukchi and Beaufort Sea coasts within the NPR-A.

Pacific Walrus

Alternative B-2 would make approximately 11.8 million acres of federally owned subsurface (about 52 percent of the total) of the NPR-A available for oil and gas leasing. Alternative B-2 would contain two Special Areas of particular benefit to walrus, a new 107,000 acre Peard Bay Special Area and the Kasegaluk Lagoon Special Area, both providing protection for walrus nearshore feeding areas and the onshore coastlines that are becoming increasingly important for walrus during ice-free periods. Coastal area lease stipulations put in place for marine mammals would place some restrictions on facility development in BLM-managed coastal waters and landward within 1 mile of the coast, although a pipeline and other necessary infrastructure associated with offshore developments could be accommodated. This alternative does not preclude development of oil and gas facilities other than oil drilling pads and central processing facilities along the coast when it is necessary that they be located within this area, and also does not preclude development of infrastructure associated with offshore oil and gas exploration and production or construction, renovation, or replacement of facilities on existing gravel sites within these special areas. It is expected the potential effects of disturbance due to development would be slightly higher for the Pacific walrus under Alternative B-2 than under Alternatives B-1 but lower than under Alternatives A, C, and D. Under Alternative B-2, the effects of most non-oil and gas activities on walrus would also largely be avoided. (Aircraft and vessel activity not subject to BLM permitting could impact walrus, but best management practice F-1 and stipulation K-6 would lessen such potential for activities subject to BLM permitting.) Walrus would continue to be profoundly affected by climate change.

4.5.12 Cultural Resources

4.5.12.1 Activities Not Associated with Oil and Gas Exploration and Development

Concerning the types of activities that generate potential impacts to cultural resources, under Alternative B-2 they are essentially the same as those that could take place under Alternative B-1. This is because the primary difference between Alternatives B-1 and B-2 are in protection designations rather than the amount of area that would be open to oil and gas exploration, development and production.

Under Alternative B-2, the types of non-oil and gas activities would be the same as those described for Alternative A (see section 4.3.12.1 in Volume 2), and the potential impacts to cultural resources would also be similar.

4.5.12.2 Oil and Gas Exploration and Development Activities

Effects of Seismic Surveys

Under Alternative B-2, the level of seismic activity could increase slightly over that of Alternative A (see section 4.3.12.2 in Volume 2) in regards to 3-D activities. It is anticipated that there could be an increase of about 4,450 survey or camp train miles, about 8 percent, and 43,345 surveying and camp train acres, also about an 8 percent increase. However, given the low probability of impact from seismic activity, this is not regarded as a meaningful increase in terms of potential impact to cultural resources. Therefore, the probability of encountering and impacting scientifically significant cultural material under Alternative B-2 remains low.

Effects of Short-term Disturbance: Exploration and Delineation Drilling

Short-term impact-producing activities include drill pads, roads, and airstrips constructed of ice and snow. Under Alternative B-2, all of these activities are reduced to approximately 251,000 acres; a decrease of about 23 percent compared to Alternative A (see section 4.3.12.2 in Volume 2). Under Alternative A, the potential adverse impact to cultural resources from short-term disturbance is considered to be low. Under Alternative B-2, where less land is available for leasing and exploration, the amount of potentially impacting activities is substantially reduced and the potential for adverse impact remains low.

Effects of Long-term Disturbance: Development of Oil and Gas Infrastructure

Under Alternative B-2 the amount of potential disturbance from construction of central processing facilities and associated satellite pads, roads, airstrips, pump or compressor stations, and gravel pits in regard to surface area (8,402 total) is reduced by 1,500 acres, about 15 percent, and a reduction of about 9 million cubic yards, about 22 percent of gravel mined, compared to that of Alternative A. Also by comparison, the number of potential vertical support members is reduced by 17,253, about 26 percent, while gas pipeline trenching increases by 57 miles, about 9 percent, adding 228,000 cubic yards to the total of excavated material and 104 acres (excavation plus spoil area) to the impacted surface or near-surface area. Overall, however, the surface or near-surface area potentially impacted is significantly reduced under Alternative B-2.

Effects of Oil Spills and Gas Releases

Under Alternative B-2, the effects of spills on cultural resources would be no different from that discussed under Alternative A. However, since there would be fewer wells drilled and less infrastructure developed under Alternative B-2, the probability of encountering and impacting cultural material is reduced. As previously described (see section 4.3.12.2 in Volume 2), there would probably be no adverse effect on cultural resources from a gas release.

Effects of Abandonment and Reclamation

As previously described (see section 4.3.12.2 in Volume 2), abandonment and reclamation of short-term and long-term infrastructure, under most circumstances, would have limited, if any, impact on cultural resources.

4.5.12.3 Effectiveness of Stipulations and Best Management Practice

Under Alternative B-2, the primary safeguard for cultural resources is Best Management Practice E-13, which states that lessees will conduct a cultural resources survey prior to engaging in any potential ground-disturbing activity. There are other regulations, laws, and procedures, which also provide protections for cultural resources (see 4.3.12.3 in Volume 2).

4.5.12.4 Conclusion

The primary potential impact to cultural resources would result from the surface or near-surface disturbance resulting from excavation of gravel, the laying down of gravel on the tundra for construction of the permanent facilities, and trenching. However, surveys for cultural resources are required to be conducted before excavation or any potential ground-disturbing activities could take place. Overall, given the effectiveness of the protections for, and the baseline data from past inventories and research regarding where cultural sites are most likely to occur, both non-oil and gas and oil and gas-related activities within the NPR-A have a very low probability of adversely impacting cultural resources. The potential effect of climate change is the same as described for Alternative A.

4.5.13 Subsistence

4.5.13.1 Activities Not Associated with Oil and Gas Exploration and Development

Under Alternative B-2, non-oil and gas-related activities requiring permits from the Authorized Officer would be subject to the protective measures outlined in Chapter 2 as well as any other applicable federal, State, and North Slope Borough regulations. Activities not associated with oil and gas exploration and development include aircraft and watercraft use, research activities (including remote camps associated with research), overland moves, and recreation. All of these activities have the potential to affect subsistence use. Refer to section 4.2.1 in Volume 2 for a detailed description of the types of non-oil and gas activities that may occur in the NPR-A.

Effects of Disturbance

Aircraft Use

Under Alternative B-2, the effects of aircraft use on subsistence would be the same as those described under Alternative A (section 4.3.13.1). Aircraft could divert migrating or insect-avoiding caribou, as well as seals, walrus, and whales from subsistence use areas. Subsistence users have repeatedly stated during scoping meetings that aircraft traffic reduces harvest access and success (Nukapigak 1998; Ahtuanguruak 2003; Kaigelak 2003; Olemaun 2003). Disrupted harvests directly impact hunters in terms of lost time, effort, and resources (primarily fuel). Subsistence harvesters also describe the stress that occurs when they are out hunting, hear a helicopter operating nearby, and worry that the helicopter will approach and disrupt the hunt.

Watercraft use

Under Alternative B-2, the effects of watercraft on subsistence harvest would be the same as those discussed under Alternative A (section 4.3.13.1 in Volume 2): localized and temporary, possibly causing subsistence species to avoid the area of activity. The low level of watercraft use is not anticipated to significantly disrupt subsistence harvesters.

Research Activities

It is likely that scientific research and data collection that is related to climate change and endangered species will continue to increase regardless of lease sales. The effects of research activities would be similar to those described under Alternative A: possible temporary and localized diversions or disturbances of subsistence species. Research activities would primarily take place in the summer months and aircraft-based research would have the greatest likelihood of affecting subsistence harvest patterns.

Recreation and Film Permits

Recreational uses of the NPR-A include hiking, rafting, canoeing, wildlife viewing and bird-watching tours that are primarily conducted by commercial guiding companies. Six to 12 permits for recreation can be anticipated per year. Under Alternative B-2, slightly more recreation could occur in the NPR-A in response to increased public awareness of new or expanded special areas. Recreation would likely be limited to summer use of river corridors. The effects would be similar to those under Alternative A: recreation could disturb the movements and habitat use of subsistence species, causing a short-term, localized effect. Recreational users would likely frequent waterways shared with other users, such as subsistence hunters, potentially resulting in resource user conflicts. If Alternative B-2 leads to a significant increase in recreation, there could be increases in user conflicts and greater effect to subsistence resources along highly utilized river corridors such as the Colville and the Utukok. The effects of these conflicts on subsistence harvest patterns would likely be localized and of short duration. As described under Alternative A, effects on subsistence species and harvest patterns caused by guided hunters in the NPR-A would usually occur outside the core subsistence use areas of NPR-A communities and would be localized and temporary.

Solid and Hazardous Waste Removal and Remediation

Solid and hazardous waste removal and remediation, including the monitoring of existing clean-up sites and aging infrastructure (e.g., wellheads) would occur under Alternative B-2 in the same manner as described in section 4.3.13.1 of Volume 2 for Alternative A. These activities would involve site characterizations, transportation of equipment over ice roads or snow trails or barge, removal of hazardous materials, possible stockpiling of contaminated materials, and eventual disposal in an appropriate facility. Effects of waste removal and remediation under Alternative B-2 would be the same as described for Alternative A: helicopter use, ice roads, and snow trails could cause temporary and localized displacement of resources, and barging presents risks to sea mammal and bowhead whale hunting. Short-term effects could include a "plume" created by clean-up activities and an increased potential for contamination of subsistence species, particularly fish, in areas around the cleanup site. Long-term effects could include a decreased potential for contamination of subsistence species. Effects on subsistence harvest patterns by this activity would be localized and temporary, although many contaminated sites are located near NPR-A communities and can therefore affect nearby resources such as fishing areas.

Overland Moves

Overland moves, such as supply trips to communities via Rolligon in the winter on frozen tundra, would occur only by permit and would be subject to the regulations outlined in Chapter 2. The effects of overland moves under Alternative B-2 would be similar to those described for Alternative A: caribou, grizzly bears, polar bears, muskoxen, wolves, and wolverines could be displaced from the immediate area of the travel route, but the effects would be localized and would vary depending on the intensity and frequency of traffic.

4.5.13.2 Oil and Gas Exploration and Development Activities

Effects of Disturbances

Seismic Activities

The effects of seismic activity under Alternative B-2 would be similar to those described under Alternative A (see section 4.3.13.2), namely, displacement of game and disturbance of subsistence activities that can lead to loss of subsistence food; loss of time; loss of money; increased stress and anxiety; increased risk of equipment failure; and increased risk of loss of life or serious bodily injury. The risk of these impacts would be greater under Alternative B-2 than in Alternative A because there would be approximately 8 percent more acres surveyed under this alternative. This small increase would most likely be felt by subsistence users of lands south of Wainwright that would be available for leasing under this alternative, but would not be available under Alternative A.

Exploratory Drilling

The types of impacts from exploratory and delineation oil and gas drilling under Alternative B-2 will be identical to those described under Alternative A in section 4.3.13.2 in Volume 2. Direct impacts to subsistence users and resources from a drilling operation would include displacement of resources away from the drill site; possible impacts to overwintering fish from water withdrawals, river crossings, and fuel spills near ice airstrips; and increased time, effort, and expense during hunting. Ice roads and/or packed snow trails are customarily used by local residents during the winter, both by snowmobile and truck/car. The presence of these types of access may concentrate hunting efforts along the route(s). In addition, increased traffic by locals increases the likelihood that resources such as caribou will be displaced from the route.

Summer activities associated with exploratory drilling involving the use of helicopters for access would result in displacement of resources due to aircraft or watercraft use; impacts to hunters from disrupted hunts; and possible increase in the amount of time, effort, and fuel needed to harvest displaced animals.

Given that exploratory and delineation drilling would be reduced by approximately 35 percent in Alternative B-2 compared with Alternative A, the effects on subsistence use would be reduced. The reduced impacts would likely be greatest for subsistence users of lands around Teshekpuk Lake or dependent upon the Teshekpuk Lake Caribou Herd and other subsistence foods from that area because of the large area centered on Teshekpuk Lake that would not be available for future leasing.

Development and Permanent Facilities

The types of impacts from development and permanent facilities under Alternative B-2 would be identical to those that are described under Alternative A. Subsistence hunters would likely avoid development areas, resulting in a shifting of subsistence use areas away from permanent facilities, including pipelines and roads. Industrial activities could displace subsistence species from traditional harvest areas. Both winter and summer oil and gas activities could result in changes to nesting and molting habitat that affect waterfowl's use of the Reserve. Fish and fish habitats could be affected by water withdrawals, gravel mines, changes to hydrologic regimes due to infrastructure (e.g., pads, roads, causeways, docks, bridges and culverts), increases in turbidity and salinity, oil and hazardous materials spills, and access to new habitats. These activities have the potential to reduce fish populations, divert fish from their normal locations, kill large numbers of fish, or contaminate fish populations and habitat.

Subsistence hunters from all NPR-A communities could be affected by air traffic spooking caribou and other game, thus reducing harvest success and creating uncertainty and stress among subsistence hunters.

Generally, the smaller oil and gas development projected for the preferred alternative (B-2) compared to Alternative A would make it less impactful of subsistence. An important difference involves the K-6 Lease Stipulation, which implements special restrictions on infrastructure near the coast. The preferred alternative (B-2) would extend the K-6 Coastal Area to the entire coastline of the NPR-A and within a mile of the coast. Under Alternative A, the K-6 Coastal Area would not include the coast from Peard Bay to Icy Cape and would only extend within 0.75 mile of the coast. However, K-6 under Alternative A prohibits new permanent infrastructure within that 0.75-mile zone, whereas K-6 under Alternative B-2 would prohibit drill pads and central processing facilities within the one mile zone but would allow infrastructure in support of offshore development and other facilities necessary for oil and gas production within NPR-A that necessarily must be within this area (pipelines, barge landings, seawater treatment plants, or spill response staging and storage areas).

Alternative B-2 would also include several new protective measures relevant for subsistence activities, including:

- C-5 Best Management Practice, which would implement stricter measures to minimize the effects of high-intensity acoustic energy from seismic surveys on fish.
- F-1 Best Management Practice, which would more strictly prohibit hazing of wildlife by aircraft.
- H-1 Best Management Practice, which would require barge operators under BLM permit to demonstrate that barging activities will not have unmitigable adverse impacts on the availability of marine mammals to subsistence hunters.
- The preferred alternative (B-2) K-1 lease stipulations establish or enlarge setbacks for permanent oil and gas facilities on several subsistence rivers, including: Colville, Ikpikpuk, Kikiakrorak, Kogosukruk, Titalik, Alaktak, Chipp, Topagoruk, Meade, Usuktuk, Nigisaktuvik, Inaru, Avalik, Kungok, Kuk, Ketik, Kaolak, Kugrua, Kolipsun, Maguriak, Mikigealik, Ivisaruk, Titaluk, Topagoruk, Usuktuk, Utukok, and Kokolik.
- Alternative B-2 would not only prohibit leasing but would prohibit new permanent oil and gas infrastructure in all but the northern section of the Utukok River Uplands Special Area, thereby protecting critical habitat for the Western Arctic Caribou Herd that is used by over 40 communities.
- Alternative B-2 would not only prohibit leasing but would prohibit new permanent oil and gas infrastructure in the area surrounding Teshekpuk Lake, thereby protecting critical habitat of the Teshekpuk Lake Caribou herd.

For specific North Slope subsistence use areas, Alternative B-2 compares to Alternative A and Alternative B-1 in the following ways:

- **Point Lay Subsistence Use Area:**
    - Under Alternative A, leasing would be allowed in the Kasegaluk Lagoon Special Area in 2014 when the deferral for the northwest (Wainwright) area expires. Under Alternative B-2, leasing, drill pads, and processing facilities are prohibited in the Kasegaluk Lagoon Special Area but infrastructure

associated with offshore oil and gas activities (i.e., pipelines) is not prohibited. (Alternative B-1 prohibits leasing and infrastructure).

- The areas of the lower Kokolik and Utukok rivers that are in the NPR-A but not in the Utukok River Uplands Special Area are surrounded by land that would be made available for leasing under Alternative B-2. This area is unplanned and thus unavailable for leasing under Alternative A.
- The prohibition of leasing and infrastructure in most of the Utukok River Uplands Special Area protects a critical part of Point Lay's subsistence use area.

- **Wainwright Subsistence Use Area:** Wainwright's nearby coastal waterbodies (Peard Bay, the Kasegaluk Lagoon, Wainwright Inlet, and the lower section of the Kuk River) would be unavailable for leasing, drill pads, and processing facilities. Infrastructure associated with offshore oil and gas exploration and development would not be prohibited in those areas. Alternative B-2 provides for a 107,000-acre Peard Bay Special Area, which would provide extra protections from oil and gas activity in important subsistence areas east of Wainwright. South of Wainwright, a section of the lower Utukok and a section of the upper Ivisaruk would be in an area available for leasing and development under Alternative B-2 that would not be available under Alternative A. Alternative B-2 would not prohibit infrastructure (i.e., a pipeline and road) in support of offshore development through the northern section of the Utukok River Uplands Special Area. This area contains the lower sections of the Kaolak, Ketik, and Avalik rivers. Alternative B-2 also establishes or enlarges setbacks for those and other rivers in the Wainwright area and prohibits leasing and infrastructure in all but the northern section of the Utukok River Uplands Special Area.

- **Atqasuk Subsistence Use Area:** The expanded Teshekpuk Lake Special Area under Alternative B-2 would provide greater protection for Atqasuk's subsistence resources and activities than Alternative A. Atqasuk depends on the Teshekpuk Lake Caribou Herd, whose calving and insect relief habitat in the Teshekpuk Lake Special Area would not be available for leasing under Alternative B-2, whereas Alternative A deferred only the lake itself. In B-2, the eastern side of the Teshekpuk Lake Special Area (nearest to Atqasuk) would be unavailable for leasing, including the land around the lower sections of the Meade and Inaru rivers. In approximately 1 million acres in and around Teshekpuk Lake, the BLM would also not permit new non-subsistence permanent infrastructure. The most important coastal waterbodies for Atqasuk are Admiralty Bay and Dease Inlet, which would be unavailable for leasing under Alternative B-2.

- **Barrow:** Alternative B-2 would be significantly more protective of Barrow residents' subsistence harvest areas than Alternative A. In Alternative B-2, the Teshekpuk Lake Special Area extends to the Native land surrounding Barrow. Nearby coastal waterbodies (Elson Lagoon, Dease Inlet, and Admiralty Bay) would be unavailable for leasing but would not preclude new non-subsistence permanent infrastructure. The lower sections of the Inaru, Chipp, and Ikpikpuk rivers would be unavailable for leasing, as would much of the lower section of the Topagaruk River. Several Barrow families have traditional subsistence camps at Peard Bay, an area that would be better protected under Alternative B-2 due to designation of the

Peard Bay Special Area and the fact that the bay itself would be unavailable for leasing.

- **Nuiqsut:** In Alternative B-2, the Teshekpuk Lake Special Area extends to the east to encompass much of Fish Creek up to the border with Kuukpik lands. Nuiqsut's primary harvest areas for fish are located in the northeast corner of the NPR-A in the Colville River, its delta channels, and near Fish and Judy Creeks. Fish provide approximately 30 to 40 percent of the community's subsistence harvest by weight. Setbacks protect subsistence uses along these waterways on BLM land in all Alternatives. This eastern section of the Teshekpuk Lake Special Area is the area with existing leases and would still be available for leasing. Nuiqsut's subsistence resources would be better protected in Alternative B-2 because it makes most of the Teshekpuk Lake Special Area unavailable for leasing and prohibits leasing and new non-subsistence infrastructure in the Teshekpuk Lake Caribou Herd's core calving and insect relief area and important waterfowl habitat in the Teshekpuk Lake area up to and including the Cape Halkett, Kogru River, and Pitt Point area. By contrast, Alternative A would only prohibit permanent oil and gas facilities within 0.25 mile of the ordinary high watermark of Teshekpuk Lake.
- **Anaktuvuk Pass:** Anaktuvuk Pass is not located within the NPR-A, but the community's subsistence use area extends into the NPR-A and the community is particularly dependent on caribou that migrate through the NPR-A. In Alternative B-2, the protections for the core habitats of the Teshekpuk Lake caribou herd and the Western Arctic caribou herd protect will protect Anaktuvuk Pass's subsistence resources.

Effects of Abandonment and Reclamation

Oil facility abandonment and reclamation activities include the removal of all equipment and facilities and the plugging of all wells. During these activities, subsistence resources and activities would be subject to impacts similar to those caused by construction as described under Alternative A (see section 4.3.13.2 in Volume 2). Following the abandonment and reclamation, subsistence resources would be subject to fewer impacts. If the gravel roads and pads were left in place and remained serviceable, they could be used by residents to access subsistence resources, possibly reducing hunting effort and time.

Effects of Oil Spills

The types of effects of oil spills on subsistence resources under Alternative B-2 are identical to those described for Alternative A in section 4.3.13.2 in Volume 2. Impacts would depend on the size and location of the spill: those on pads are less likely to have impacts, those on the tundra could affect small numbers of terrestrial mammals, and those that directly enter a waterbody could spread widely and be toxic to fish and waterfowl, leading to long-term, population level effects. Subsistence harvesters would likely not take caribou or other consumable resources from the general area. As described for Alternative A, the Iñupiat consider contamination from oil spills in nearshore waters to be a catastrophic possibility that would threaten their very existence (Brower 1976; Itta 2001). Impacts could include injury or death to bowhead whales and other marine mammals or a shift in the migration routes of these species. The loss of an important source of subsistence food would result in financial hardship and increased pressure on terrestrial subsistence resources. Such an event could also trigger a reduction in the International Whaling Commission subsistence bowhead whale quota, which would cause hardship for all subsistence whaling communities in Alaska, Canada's Arctic, and Chukotka.

Although the types of impacts of oil spills would be identical under all alternatives, the number of small spills and the chance of a large spill that would affect subsistence species would be less under Alternative B-2 than under Alternatives A, C, or D and slightly more than under Alternative B-1. Also, the fact that nearshore environments in the NPR-A would be unavailable for leasing under Alternative B-2 reduces the risk of spills in these particularly critical environments.

4.5.13.3 Effectiveness of Stipulations and Best Management Practices

Many of the protective measures outlined in Alternative B-2 are intended to ensure the continued health of subsistence resources and to promote a responsive relationship between subsistence users, the BLM, and oil and gas companies.

Alternative B-2 provides important measures that are explicitly aimed at minimizing conflicts between subsistence users and other activities. H-1 is designed to prevent unreasonable conflicts by requiring that a prospective lessee/permittee consult directly with affected communities to discuss the timing, location, and methods of their proposed operations. An applicant must document its consultation efforts as part of its plan of operation and must submit the plan of operations to the National Petroleum Reserve in Alaska Subsistence Advisory Panel for review and comment. An applicant must submit said plan sufficiently early to provide time for review by the Subsistence Advisory Panel and, if necessary, for Government-to-Government consultation with Native Tribal governments. Among other items, the operations plan must describe methods the applicant will use to monitor the effects of the activity on subsistence and must describe how the applicant will keep potentially affected individuals and communities up-to-date on the activities and locations of possible conflicts with subsistence users. Whereas the objective of Required Operating Procedure H-1 under Alternative A is focused on oil and gas activities, the objective of Best Management Practice H-1 under Alternative B-2 is expanded to reflect the fact that research and other events can also disturb subsistence areas and users.

In addition to the consultation process detailed in H-1, Best Management Practice H-2 is intended to prevent unreasonable conflicts between subsistence activities and seismic exploration by mandating that an applicant for seismic exploration shall notify local Search and Rescue operations of current and recent seismic surveys and shall notify in writing all potentially affected cabin and camp users.

Effectiveness of Stipulations and Required Operating Procedures/Best Management Practices on Subsistence Species

Many of the protective measures outlined in Alternative B-2 are intended to minimize the surface impacts of oil and gas activities and to otherwise ensure the continued health of wildlife and subsistence resources. For a complete description of the measures under Alternative B-2 that are designed to mitigate impacts to fish, birds, terrestrial mammals, and marine mammals, please refer to the sections for those resources in Chapter 4, Alternative B-2. Although Alternative A has many similar measures designed to protect subsistence species in particularly sensitive areas, many of these species and areas would be more effectively protected under Alternative B-2 because the areas would not be available for leasing, and corresponding measures under Alternative B-2 would apply to existing leases. Measures that are particularly relevant to subsistence species are listed below and specific differences that would make the measures more or less effective under Alternative B-2 are noted.

- A-4 minimizes the impacts of contaminants on fish, wildlife, and the environment, and A-11 would mandate, for all permanent development, the design and implementation of a study to monitor contaminants in subsistence foods.
- Measures that minimize disruption of caribou include E-7, K-9, K-10, and K-12. E-7, which regulates the characteristics of pipelines, would be more effective under Alternative B-2 because it includes an additional requirement that all aboveground pipelines would have a non-reflective finish. K-12 protects habitat of the Western Arctic Caribou Herd and has no comparable provision under Alternative A.
- K-6 is a measure that minimizes hindrance of caribou movement within caribou coastal insect-relief areas. Its objective, under Alternative B-2, has been expanded to protect the summer shoreline habitat for polar bears, walrus, and seals. As noted above, K-6 under B-2 would be a wider zone (one mile) but would only prohibit drill rigs and processing facilities while it would allow necessary infrastructure to support offshore development or existing leases.
- To protect fish habitat, measures B-1 and B-2 regulate water withdrawals, K-1 establishes setbacks along rivers, and C-2 to C-4 protect streams and prevent additional freeze down of deep-water pools. As noted above, K-1 would be more effective under Alternative B-2 than under Alternative A because it establishes more and larger setbacks.
- K-3b sets significantly higher standards for oil and gas activities in major coastal waterbodies.
- E-10 minimizes the chances that migrating waterfowl will strike oil and gas facilities during low light conditions.

Unlike Alternative A, Alternative B-2 includes a provision (Best Management Practice H-3) that minimizes impacts to important subsistence species by prohibiting employees of the oil and gas industry or other permitted activities to hunt or trap while working. This measure addresses a key concern of subsistence hunters, which is the encroachment of outside hunters and any resulting competition for resources.

Effectiveness of Stipulations and Best Management Practices on Subsistence Harvest Patterns

In general, best management practices and lease stipulations seek to protect specific resources by establishing spatial buffer zones around facilities and infrastructure, scheduling disruptive activities when there is the least potential for conflicts with other users, making efforts to include community residents in project planning, monitoring effects on subsistence resources, and making efforts to minimize the interference of oil and gas exploration and development activities and structures with subsistence resources and users. For example, I-1 is a measure that minimizes conflicts with subsistence users by requiring orientation programs for oil and gas company employees. These programs include information on location-specific environmental, cultural, and social concerns as well as information about subsistence activities and the potential of aircraft use to disturb subsistence users.

Aircraft use near traditional subsistence cabins and campsites during spring goose and fall caribou and moose hunting is a particularly common concern. By mandating minimum flight altitudes, Best Management Practice F-1 mitigates the effects of low-flying aircraft on wildlife. This is effective when practicable and when obeyed, however, it is difficult to enforce and, as mentioned above, there are three major exemptions: wildlife surveys, foul weather, and take offs and landings. Furthermore, the BLM has no authority over private aircraft or aircraft used by projects that do not have BLM permits. BLM-chartered aircraft and aircraft use by BLM permittees accounts for a small percentage of the aircraft use in the NPR-A; therefore, the BLM is not able to effectively mitigate the wider problem. The BLM has implemented a system whereby subsistence users notify the BLM of problem aircraft and the BLM attempts to track down the pilots or owners of the aircraft. Nevertheless, aircraft interference with subsistence activities continues to be a primary impact of oil and gas and other activities in the NPR-A. Several residents of Nuiqsut contend that the nuisance caused by aircraft is at such a high level that they no longer support roadless development, which was previously the preferred option. According to these residents, roads and road traffic through town would have many advantages and disadvantages, but on the whole would be preferable to the high number of overflights that the community currently endures (USDOI BLM 2010).

Several measures provide specific limitations on development near subsistence sites. Lease Stipulations K-1, K-2, and K-3 would minimize impacts to subsistence cabins and campsites and disruptions to subsistence activities by prohibiting permanent oil and gas facilities (e.g., gravel pads, roads and airstrips, and pipelines) through setbacks areas around rivers, lakes, and coastal waterbodies. Lease Stipulation K-6 is intended to minimize impacts to subsistence activities from permanent oil and facilities in coastal areas by implementing, to the extent practicable, a setback of a mile from the coastline and by mandating the use of previously occupied sites (e.g., Camp Lonely, various Husky/USGS drill sites, and Distant Early Warning-Line sites) when possible. K-6 under Alternative A prohibits new permanent infrastructure within that 0.75-mile zone, whereas K-6 under Alternative B-2 would prohibit drill pads and central processing facilities within the one mile zone but would allow infrastructure in support of offshore development (i.e., pipelines) and other facilities necessary for oil and gas production within NPR-A that necessarily must be within this area (barge landings, seawater treatment plants, or spill response staging and storage areas).

Other measures that are particularly relevant to subsistence harvest patterns include:

- E-1, which requires that all roads be designed to protect subsistence use and access to traditional hunting and fishing areas.
- E-2, E-3, E-6, and E-8, which maintain subsistence use and access to traditional subsistence fishing sites.
- E-7, which mandates pipeline height to provide for the safe and unimpeded passage of subsistence hunters.

The actual effectiveness of protective measures depends heavily on their ongoing implementation, on enforcement, and on the precise location of facilities and infrastructure. Effectiveness is also dependent on the sharing of local knowledge and on informed input from residents of affected communities. As described above, several measures are designed to ensure that subsistence hunters participate in plan design. However, municipal governments and tribal governments generally have limited funding and few paid staff, and members of these organizations feel overtaxed when asked to provide meaningful input to the BLM on proposed or permitted activities. This institutional overload affects subsistence users by placing increased, non-compensated demands on their time, further reducing the time available for subsistence pursuits. Many such NPR-A residents contend that the change from the prescriptive lease stipulations that were put in place by the 1998 Northeast IAP/EIS to the performance-based rules put in place by subsequent IAP/EISs forces them to spend more time defending subsistence interests because compliance is now defined in terms of meeting management objectives rather than adhering to absolute standards. The contention that it now takes more time to review and to effectively respond to industry proposals was reiterated during scoping meetings in 2010 (USDOI BLM 2010).

The BLM has found that performance-based regulations provide equal protection with greater flexibility and project relevance. The flexibility of the performance-based approach places greater reliance on on-going monitoring to ensure that regulations are in fact achieving the desired level of protection. The BLM is committed to directing the resources necessary for on-going monitoring, including support for the Subsistence Advisory Panel to provide oversight, exchange information, and develop solutions for emerging issues.

4.5.13.4 Conclusion

Subsistence activities in all NPR-A communities could be directly affected by development activities under Alternative B-2. Alternative B-2 makes 52 percent (11.8 million acres) of the NPR-A available for leasing. However, Alternative B-2 emphasizes the protection of surface resources and it is likely that fewer acres would be disturbed overall by direct oil and gas activities under Alternative B-2 than under Alternatives A, C, or D. Alternative B-2 would not protect as much subsistence use area from development as Alternative B-1 would, but Alternative B-2 provides stronger protections for subsistence rivers than any other Alternative.

The effects of non-oil and gas activities on subsistence species under Alternative B-2 would be similar to those that would occur under Alternative A. There could be less exploration and development-related scientific research associated with onshore development under Alternative B-2 than under Alternatives A, C, and D because fewer areas would be available for leasing, and slightly more than under B-1. This preferred alternative (B-2) does not prohibit onshore infrastructure to support offshore development in the coastal area. If studies for a pipeline and associated infrastructure to transport offshore oil and gas continue, the preferred alternative (B-2) could result in more development related scientific research than Alternative A. The impact of non-oil and gas activities is greatly dependent on the time and precise location of said activities. Activities would be, in most cases, of limited duration and magnitude, and effects on subsistence would be limited to the immediate area of the activity.

Primary impacts could include the avoidance of traditionally used subsistence areas due to development and aircraft use as well as anxiety over this loss; the deflection of caribou and other important subsistence resources from areas of activity; increased difficulty harvesting caribou and other subsistence resources; the necessity to make longer and more distant trips in order to have a successful harvest, and the increased cost, risk, and time commitment this entails. The effects of disturbance from permanent oil and gas facilities on terrestrial mammals during the production phase would be of relatively long duration, but would be local in nature. However, decreased opportunities to harvest terrestrial mammals could be especially problematic if climate change inhibits fall travel by delaying freeze up or causes subsistence species to shift their migration routes or schedules. If climate change causes Arctic Ocean ice to retreat farther from the shore, it will make the harvesting of whales and other marine mammals more difficult, which could in turn increase pressure to harvest terrestrial subsistence foods. Under Alternative B-2, both winter and summer oil and gas activities could result in changes to nesting and molting habitat that affect waterfowl's use of the Reserve. Fish and fish habitats could be affected by development activities that could potentially reduce fish populations, divert fish from their normal locations, kill large numbers of fish, or contaminate fish populations and habitat.

In particular, the complete prohibition of new oil and gas infrastructure in the area around and north of Teshekpuk Lake and in most of the URUSA protects areas critical to subsistence species. By enlarging three special areas, creating one new special area, and making leasing unavailable in coastal waterbodies and in much of a greatly enlarged Teshekpuk Lake Special Area, Alternative B-2 provides significantly more security for key subsistence species and use areas than Alternatives A, C, and D. In particular, the risk of direct and indirect impacts to subsistence harvests in Nuiqsut, Barrow, and Atqasuk, is reduced under Alternative B-2. Because Alternative B-2 has more measures to accommodate possible future onshore infrastructure to support offshore development than Alternatives A or B-1, it indirectly poses greater risks to the subsistence use areas of Point Lay and Wainwright given that a pipeline to transport Chukchi Sea oil would not be prohibited from coming onshore in the Kasegaluk Lagoon or Peard Bay.

4.5.14 Sociocultural Systems

Please refer to section 3.4.4, "Sociocultural Systems" in Volume 1 for background information on cultural values, social organization, and social health in the NPR-A's Iñupiaq communities.

4.5.14.1 Activities Not Associated With Oil and Gas Exploration and Development

Under Alternative B-2, the effects of non-oil and gas activities on sociocultural patterns would be the same as under Alternative A. Please refer to section 4.3.14.1 in Volume 2 for a more inclusive analysis of the impacts of non-oil and gas activities on Iñupiaq sociocultural systems. The amount of research related to climate change and endangered species is likely to increase regardless of development scenarios. These research efforts and associated aircraft use could cause temporary and localized diversion or deflection of subsistence species for as long as the studies were underway. Alternative B-2 could result in an increase in recreation in the NPR-A and a corresponding increase in the number of user conflicts. It is not expected that the amount of soil and hazardous waste removal would be greater under Alternative B-2 than under the other alternatives or that the number of overland moves would change significantly. In general, effects from non-oil and gas activities under Alternative B-2 would be temporary and localized, and would be unlikely to affect overall sociocultural patterns.

4.5.14.2 Oil and Gas Exploration and Development Activities

Oil and gas exploration, development, and production would require a seasonal network of snow and ice roads and a permanent network of production facilities, pipelines, power lines, and gravel roads, runways, and pads in the NPR-A. The percentage of this network associated with gas could be higher under Alternative B-2 than under Alternative A and gas exploration and development activities would likely impact NPR-A communities that are currently less accustomed to development. The overall extent of industrial development associated with onshore oil and gas activities in the NPR-A would be less under Alternative B-2 than under Alternatives A, C, and D. By making much of an expanded Teshekpuk Lake Special Area unavailable for leasing and the area around the lake itself unavailable for infrastructure, Alternative B-2 is particularly significant for the resilience of Iñupiaq sociocultural systems. As stated above, this area is highly utilized for subsistence purposes, and continued use of the land results in several positive cultural values including the transfer of knowledge between elders and youth related to those areas; the integrity of culturally important places; and the importance of hard work, cooperation, and sharing.

Effects of Disturbances

The types of effects on sociocultural patterns from disturbances caused by oil and gas activities under Alternative B-2 would be the same as under Alternative A, but would be reduced in intensity and duration. Decreases in the area available for leasing and exploration would correspond to a decrease in effects to subsistence harvests as compared to those for Alternative A. The development proposed for the NPR-A under Alternative B-2 would result in less staging and overland travel during the winter and in summer would result in decreased use of aircraft for supplies, equipment, and crew changes, as compared to the other alternatives. In all seasons, noise, lights, personnel, and traffic near the anticipated oil and gas infrastructure could temporarily deflect or divert caribou in areas where activities are occurring.

Gravel pads or roads could provide caribou with insect-relief habitat, but these effects could change the distribution, timing, and location of the caribou harvest. Subsistence hunters could be diverted from oil and gas facilities at distances from 5 to more than 25 miles as a result of their desire to harvest away from production facilities, which could require increased effort and expenditure on the part of subsistence hunters. Given the high gasoline costs on the North Slope, this would add additional cost to subsistence harvests. Increased fuel costs and wear and tear on hunters and their equipment could increase the need for search and rescue missions and could increase the need for wage labor to support subsistence pursuits. This would reduce the time available to pursue subsistence activities, which would result in sociocultural consequences such as increased stress and a decreased sense of well-being. These problems are discussed in more detail in section 4.5.21, "Public Health." Increases in the speed, range, and reliability of outboards and snowmobiles have facilitated the mixed subsistence and wage economy, but could not compensate for impacts to subsistence harvest activities from continued development and production activities in important subsistence harvest areas. Under Alternative B-2, these impacts would likely be experienced less frequently by residents of Nuiqsut, Barrow, and Atqasuk who utilize the

Teshekpuk Lake area because of the prohibition of new leases in that area and there would be fewer incidences of competition/overlapping subsistence use areas between these communities. However, these impacts may be experienced more frequently by residents of Wainwright and Point Lay if oil and gas activities increase in those communities' subsistence use areas that are available for leasing under Alternative B-2.

As discussed under Alternative A, long-term change to sociocultural patterns would result from a weakening, through prolonged stress and disruptive effects, of traditional institutions that have stabilizing effects within the society. Activities occurring under this alternative would exacerbate those effects, but to a lesser extent than activities under the other alternatives. These changes are already occurring on the North Slope because of migration to urban areas, onshore and offshore oil and gas development, more dependence on a wage economy, higher levels of education, improved technology, improved housing and community facilities, improved infrastructure, increased presence of non-Alaska Natives, increased travel outside of the North Slope, and increasing penetration of television and the Internet. Data from other circumpolar Inuit populations suggest that continued modernization is associated with a trend toward displacement of sociocultural systems, including: a trend toward less time being spent conducting subsistence harvest activities; less subsistence consumption among younger generations; a greater focus on a cash-based economy, as opposed to the egalitarian sharing network; an increased importance on the nuclear family, as opposed to the more-traditional extended family structure (Curtis et al. 2005; Nobmann et al. 2005; Condon et al. 1995). North Slope Borough institutions, such as the school district that promotes the teaching of Iñupiaq language and culture, the Arctic Eskimo Whaling Commission that negotiates with industry to protect Iñupiaq subsistence whaling interests, the North Slope Borough Department of Wildlife Management, and other regional and village Native corporations and organizations have been working to prevent the weakening of traditional Iñupiaq cultural institutions and practices. A number of social impacts are associated with increased contact with outside groups; however, there currently appears to be a high level of separation, acceptance, and indifference between residents and workers in NPR-A communities. Under all alternatives, it is estimated that an influx of oil and gas workers today would represent a negligible fraction of the overall impact from modernization and the global economy.

Effects of Abandonment and Reclamation

At present, very few NPR-A residents have jobs in the oil fields (Circumpolar Research Associates 2002). Abandonment and reclamation activities would likely generate jobs for local residents for several years and at greater levels of employment than would exist during the operational phase. If local residents were to become substantially integrated into oil field operations, their families could face economic difficulty as fields were abandoned. North Slope communities, due to the support of the North Slope Borough, are already dependent on revenues associated with oil development. If no oil fields were active in the area to provide jobs and contribute economically to the local economy and government revenue, the region would face a time of economic depression, which is associated with increased social pathology in Iñupiaq communities, as discussed in section 4.5.21, "Public Health." The Arctic Slope Regional Corporation dividends, which are less dependent on local resource development, could provide some mitigating financial support if oil and gas revenues decrease. However, no potential avenues for maintaining income at the standards established in the oil development era have been identified. Abandonment and reclamation activities would restore habitat for caribou and other subsistence species and subsistence resources would thereafter be subject to fewer impacts, potentially improving subsistence opportunities.

Effects of Oil Spills

Under Alternative B-2, the likelihood of a spill event with the potential to damage unique critical habitats and subsistence use areas is less than under the other alternatives. The effects of oil spills would be the same as those discussed in Alternative A: effects would vary in severity depending upon the timing and location of the spill event, but fish, waterfowl, and marine and terrestrial mammals could all be affected. An oil spill could result in contamination of subsistence resources and would be a threat to the health and lifestyle of the affected communities. If a large oil spill occurred in a traditional use area, then subsistence users would have to travel further to harvest uncontaminated resources, which could result in high effects to sociocultural patterns for a much longer time than the period that subsistence resources would be measurably contaminated. An oil spill that reached coastal waters could affect the harvest of marine mammals, including bowhead whale harvests, which are at the center of Iñupiaq sociocultural organization. The preclusion of leasing in nearshore coastal waterbodies under Alternative B-2 is a management action that significantly reduces the threat of an oil spill in these particularly important environments.

Activities associated with cleanup of an oil spill could have an effect on sociocultural systems. In the event that a large spill contacted and extensively oiled fish and wildlife habitats, the presence of hundreds of humans, boats, and aircraft would increase the displacement of subsistence species and alter or reduce access to subsistence species by subsistence hunters. These events would supply short-term employment for local residents, potentially at the expense of subsistence activities and subsistence resource availability. Because it is expected that oil spills from authorized activities would be small events and would normally be contained on the drill pad, effects from the spills themselves and potential disruptions from clean-up activities would be unlikely to cause excessive disturbance to sociocultural systems or the surrounding environment. A large oil spill, however, would be catastrophic to the sociocultural structure of the whaling peoples of the North Slope if it were to occur in a riverine, nearshore, or marine environment.

4.5.14.3 Effectiveness of Stipulations and Best Management Practices

The management actions proposed under Alternative B-2 would not allow oil and gas leasing in several culturally and environmentally important areas and would enlarge three Special Areas and create one new Special Area. In addition, the stipulations and protective measures that would be put in place by Alternative B-2 provide a higher level of protection along several rivers and in other sensitive areas. Because subsistence is an inherent component of cultural values, kinship, and social health, the description of the measures under Alternative B-2 that are relevant to subsistence species and subsistence access (is also applicable to this summary of sociocultural impacts. Best Management Practice H-1 provides opportunities to affected communities for participation in planning and decision making to prevent unreasonable conflicts between subsistence users and oil and gas related activities. This Best Management Practice would allow NPR-A residents to be more aware of science and research projects in their region and to suggest changes or additions to those projects so that Iñupiat sociocultural systems are better served by them.

Particularly relevant for sociocultural systems is the wider setbacks from rivers that are most commonly used for subsistence in Alternative B-2 and Best Management Practice I-1, which would require the lessee to provide a cultural orientation program for all oil and gas personnel involved in NPR-A activities in order to effectively minimize cultural and resource conflicts with local inhabitants. This orientation program, as it relates to subsistence pursuits and cultural concerns, would: (1) provide sufficient detail to notify personnel of applicable lease stipulations and required operating procedures, as well as inform them about specific types of environmental, social, traditional, and cultural concerns that relate to the region; (2) address the importance of not disturbing archaeological and biological resources and habitats, and provide guidance on how to avoid disturbance; (3) be designed to increase sensitivity and understanding of personnel to community values, customs, and lifestyles in areas where personnel would be operating; (4) include information about avoidance of conflicts with subsistence, commercial fishing activities, and pertinent mitigation; and (5) include information for aircraft personnel concerning subsistence activities and areas and seasons that are particularly sensitive to disturbance by low flying aircraft (e.g., aircraft use near traditional subsistence cabins and campsites, flights during spring goose hunting and fall moose hunting seasons, and flights near North Slope communities).

4.5.14.4 Conclusion

Alternative B-2 makes nearly 11.8 million acres of federally owned subsurface (52 percent of the total in NPR-A) immediately available for oil and gas leasing. This allows for development to sustain North Slope Borough revenues and thus for the important socioeconomic support the North Slope Borough provides in NPR-A communities. As described above, it does not alleviate the long-term issue of maintaining income at the standards established in the oil development era. Under Alternative B-2, many areas of importance to subsistence users, including areas surrounding subsistence camps, critical habitat for subsistence species, and large concentrations of historic and prehistoric cultural resources, would be protected from the impacts of oil and gas activities. For example, several families from Atqasuk, Barrow, and Nuiqsut use cabins, camps, caches, and other sites along the coast, inland to Teshekpuk Lake, and along the Chipp and Topagaruk rivers for subsistence activities. Use of these areas helps maintain family connections and a feeling of relatedness and stability, which could be secured by the prohibition of leasing. The protections that Alternative B-2 provides for Peard Bay and the Peard Bay Special Area would create similar securities for Barrow and Wainwright families that use that area. Wainwright families would benefit from the prohibition of leasing in Wainwright Inlet/Kuk River and Kasegaluk Lagoon although the preferred alternative (B-2) would not prohibit a subsurface pipeline below the Wainwright Inlet/Kuk River and the community will face unique sociocultural impacts if it continues to develop into a hub for offshore development.

Impacts from oil and gas activities, although decreased under Alternative B-2 compared to the other alternatives except B-1, will continue to affect NPR-A communities and could increase overall. If marine traffic, including the barging of equipment to staging areas, increases in the near shore areas of the Beaufort and Chukchi seas, bowhead whales could be deflected or their behavior made more dangerous to hunters (North Slope Borough 2004). Increased traffic and activity could also make subsistence harvesting more difficult for residents who do not own or have access to motorized transportation or depend on walking, trucks, and off-highway vehicles to travel to harvest areas. Traffic around communities could isolate the community from subsistence resource harvest areas and could prevent residents from using their homelands, subsistence cabins and camps, and unspoiled open areas for resource harvests and pursuits. This would further degrade the quality of life and connection of people with their land and environment. In addition, should harvests decrease, resources would no longer be available in amounts suitable for sharing, resulting in changes in social organization and cultural values.

While federal subsistence management responsibilities would remain unchanged under all alternatives, many subsistence users in the NPR-A communities are doubtful about the consultation process and about the BLM's commitment to protecting subsistence and the subsistence culture. The BLM initiates consultation by informing interested parties of the proposed action, and inviting said parties to participate in consultation, the nature of which is to be determined by mutual agreement. If informed parties have no issues and do not wish to participate in further discussions, that is their choice and consultation may be complete, although the BLM will continue to communicate and inform those entities initially contacted for consultation throughout the planning process. Some NPR-A residents have expressed during the scoping meetings for this and previous NPR-A IAP/EISs that they are frustrated by the reoccurring demands put on them to review and provide relevant comments on IAP/EISs every few years and on each industry proposal as they arise. This does not build confidence on the part of the communities, and reinforces their feelings of being powerless to oppose changes being imposed by outside agencies and industry. As a result, some residents regard any effort to participate in consultation or other management processes as futile. This can create a feedback loop of decreased participation, decreased interest in cooperation with agencies, and increased conflict between agencies, lessees, and local resident groups as evidenced in scoping transcripts for over 30 years of hearings held on the North Slope. The management actions and protective measures that would be put in place by Alternative B-2 would alleviate this tension to a significant extent because no new leases would be allowed in the culturally important Teshekpuk Lake Special Area or nearshore environments. Alternative B-2 addresses community subsistence concerns to a greater degree than Alternatives A, C, and D and thus would not significantly exacerbate social stress and other threats to Iñupiaq sociocultural systems.

4.5.15 Environmental Justice

4.5.15.1 Activities Not Associated With Oil and Gas Exploration and Development

The non-oil and gas activities likely to occur in the planning area would primarily be transitory in nature, of short duration, and highly localized. They could temporarily divert, deflect, or disturb subsistence species from their normal patterns. Non-oil and gas activities could alter the availability of subsistence species in traditional harvest areas, which could affect harvest patterns by requiring hunters to travel further in pursuit of resources. Increased travel distances would result in greater expenditures for fuel and equipment, and increased wear and tear on snowmobiles, outboards, and four-wheel vehicles and could result in a higher risk of accidents. Consequently, there could be an effect on the subsistence hunting activities of the local minority population as a result of non-oil and gas activities. Under Alternative B-2, these effects would be the same as those described under Alternative A: minor, temporary, short term, and generally highly localized. As outlined in section 4.5.21, "Public Health," this could result in isolated problems of social pathology.

4.5.15.2 Oil and Gas Exploration and Development Activities

Effects of Disturbance

Under Alternative B-2, disturbances caused by oil and gas activities would be the same as those discussed under Alternative A, but their effects on subsistence would be decreased in magnitude, extent, and duration. Several areas that are available for year-round occupation and development under Alternative A would be unavailable for lease and year-round surface occupation under Alternative B-2. Exploration and development activity could last 50 to 60 years, followed by 2 to 5 years of abandonment activity. This timeframe would likely represent the duration of effects for species unable to habituate to the oil and gas development activities. Public health effects relating to sociocultural and dietary change, as well as exposure to contaminants, could persist for considerably longer.

Alternative B-2 could have long-term effects on several terrestrial mammal species. Effects on caribou herds would likely be less than under Alternative A (see section 4.5.9, "Terrestrial Mammals"). Little or no effect on marine mammals would be expected from onshore activities under Alternative B-2, but noise and disturbance associated with offshore barge and vessel traffic could impact bowhead whale migration patterns. There are concerns that, depending on the particular activity and, especially, the location of the activity, actions occurring under Alternative B-2 could cause local effects on fish populations. All of these effects would be experienced primarily by the subsistence dependent minority Iñupiaq population.

Under Alternative B-2, the possibility of public health impacts would be decreased compared with Alternative A. Impacts would occur primarily through restrictions in subsistence, new access routes to the community, sociocultural and economic change, altered employment, and contaminants. Given that Alternative B-2 involves substantially less development in and near particularly sensitive habitat and hunting and fishing areas, the risk of dietary change and the resultant increases in metabolic disorders would appear to be significantly decreased. Food insecurity would likely decrease substantially, and hunger could decrease as well if substantial impacts on subsistence harvests are alleviated. Cancer, lung disease, endocrine disruption, and neurodevelopmental delay are related to contaminants common to oil and gas development. The risks of these problems would be decreased under Alternative B-2. Although social pathology could result from subsistence impacts and economic changes, it is estimated that stress and maladaptive coping will be less than would occur under Alternative A due to the wider regions of important traditional use areas that are protected.

Effects of Abandonment and Reclamation

Abandonment and reclamation activities would likely generate jobs for local residents for several years above the level that would exist during operations. Activities associated with dismantling and removing of production pads and facilities could disproportionately impact NPR-A residents through disturbance, displacement, and mortality of subsistence resources, through subsistence users' avoidance of areas undergoing dismantlement and removal, and through potential impacts to water, air quality, and noise. Once abandonment and reclamation were completed, NPR-A residents would be disproportionately impacted by the reduction in local and Native corporation revenues and by fewer local jobs and business opportunities. Since economic depression is associated with increased social pathology, this could result in increases in domestic violence, injury, drug and alcohol problems, and suicide. Local residents could benefit from a reduction in impacts on subsistence resources, compared to during construction and operation.

Effects of Oil Spills

As discussed elsewhere, the magnitude of effects of a crude oil spill on subsistence resources would depend on the context of the spill, the volume and area covered by spilled product, and the amount of time before clean-up efforts commenced. Tundra oil spills could affect small numbers of terrestrial mammals and waterfowl unable to avoid the spill area, but would be unlikely to have population level effects. Oil spills (any size) directly into a water body, particularly in difficult to contain conditions such as breakup or broken ice, could spread widely and have effects on fish and waterfowl. In the nearshore environment, a large to very large spill, particularly during broken ice or storm conditions, could affect marine mammals including seals, and beluga and bowhead whales. Oil spills can also be associated with toxicological health effects in human populations, as outlined in section 4.5.21, “Public Health.” Furthermore, if a large spill resulted in a substantial decrease in consumption of subsistence foods, food insecurity and hunger as well as diabetes and related metabolic disorders could increase.

The Iñupiat consider contamination from oil spills in nearshore waters to be a catastrophic possibility that would threaten their very existence, primarily because of the potential effects of spills on bowhead whales, which are a very important part of their culture in addition to being a favored food source (Brower 1976; Itta 2001). Potential effects on subsistence harvest patterns would be less under Alternative B-2 than under Alternative A because oil and gas activity would potentially occur over a smaller area in the planning area than under Alternative A, and there would thus be less potential for oil spills. A major oil spill on the North Slope would result in effects that would impact Iñupiaq subsistence users more than any other human group.

4.5.15.3 Effectiveness of Stipulations and Best Management Practices

The lease stipulations and best management practices for Alternative B-2 would protect subsistence resources to a greater extent than the lease stipulations under Alternative A. Best Management Practices H-1 and H-2 would be highly effective in reducing conflicts between subsistence uses and oil and gas and other potentially disruptive activities.

4.5.15.4 Conclusion

Several lease sales have already taken place in the planning area and additional exploration programs and development are expected. The effects of these activities would continue under Alternative B-2, but would be significantly reduced as compared to Alternative A due in part to the prohibition of leasing in critically important subsistence and cultural areas. Most effects of disturbance would still be short term, but the extent and magnitude would likely decrease. Effects from oil spills would depend greatly on the size, location, and season of the spill. Small spills on gravel pads would have little or no environmental justice effects. A major spill into a watercourse, on the other hand, could have long-term serious effects on Iñupiaq subsistence activities. While any large spill would have serious consequences, the worst, from an environmental justice standpoint, would be one that occurred in a key harvest area or near a community. The risk of such a spill is greatly reduced by the prohibition of leasing in coastal waterbodies and the Teshekpuk Lake Special Area under Alternative B-2. Alternative B-2 would not prohibit infrastructure associated with offshore development in the Kasegaluk Lagoon, but an impact analysis of such infrastructure is outside the scope of this IAP/EIS other than the sections addressing it in section 4.8 of Volume 4, “Cumulative Effects.”

Although reduced as compared to Alternatives A, C, and D, the activities likely under Alternative B-2 could have substantial health effects, as outlined above and discussed in detail in the Public Health analysis of Alternative B-2. Because the population within and near the planning area is primarily comprised of Iñupiat, any health effects that occur would disproportionately affect this minority population.

4.5.16 Recreation Resources

Alternative B-2 would allow leases to be offered for oil and gas exploration and development on 52 percent of NPR-A subsurface lands. Another 1.57 million acres would remain deferred from oil and gas leasing until 2014; and 425,000 acres would be deferred until 2018. There are 13.35 million acres that would be recognized as special areas (Teshekpuk Lake Special Area, Colville River Special Area, Utukok River Uplands Special Area, Kasegaluk Lagoon Special Area, and Peard Bay Special Area). Alternative B-2 would not recommend any rivers be designated as Wild and Scenic Rivers.

4.5.16.1 Activities Not Associated with Oil and Gas Exploration and Development

Under Alternative B-2, recreation resources could be affected in the same way as Alternative A from activities not associated with oil and gas exploration and development. Alternative B-2 emphasizes the protection of surface resources of the NPR-A and makes portions of the Reserve unavailable for leasing, neither of which would change the effects of activities not associated with oil and gas as compared to Alternative A.

4.5.16.2 Oil and Gas Exploration and Development Activities

Ice Roads, Ice pads, Airstrips and Snow trails

Ice roads, pads, airstrips, and snow trails are temporary in nature and traversed during the winter months. Ice roads provide seasonal routes for heavy equipment supplies and movement of personnel to remote staging areas or well locations. Ice airstrips are used to transport crews and supplies to and from sites. Snow trails provide seasonal routes for use by low-ground pressure vehicles and used for moving equipment, supplies, personnel accommodations, and drill rigs capable of disassembly into components small enough for transport on such vehicles. Under Alternative B-2, the estimated total seasonal acres impacted by ice roads, ice pads, airstrips and snow trails is 249,961 acres or 83,320 miles. Activities in the winter would be far less visible due to the limited daylight hours. Due to the remoteness and climate of the Reserve, and typical type and frequency of recreation use taking place in the winter, there would be minimal if any affect from these activities.

Seismic, Exploration and Delineation Wells

Under Alternative B-2, there could be up to 11 seismic surveys, 5 exploration-focused and 6 production-focused for a total estimated short-term impact of 581,397 acres or 61,093 miles (see Table 4-11 in Volume 2) for surveying and camp train use under Alternative B-2. The surveys use low–ground-pressure vehicles to minimize potential impacts to the tundra. The typical survey lasts about 100 days. Seismic camps, which generally consist of six camp strings of five ski-mounted trailers, are typically moved every few days to once a week. Onshore seismic surveys on the North Slope are only collected in the winter. The activity would be temporary and disturbance lasts only while the survey or camp train is passing through.

Exploration drilling that has taken place since 1999 involved no more than two drill rigs active simultaneously in the NPR-A in any given season. The estimated number of drill rigs per year under Alternative B-2 for exploration and delineation is two oil rigs and three gas rigs. While a rig could be used for multiple wells, each rig could only be used at one site at a time. Typically, drill rigs are removed from the Reserve at the end of the winter drilling season. Drilled wells are either plugged or capped for reentry at a later date. Approximately 912 acres would have short-term impacts from exploration and delineation wells under Alternative B-2. Recreation resources could be minimally impacted from the moving camps and associated noise from generators, aircraft, and human presence. The impact would be minimal, temporary, and confined to the immediate area.

Activities in the winter would be far less visible because of the limited daylight hours. Due to the remoteness and climate of the NPR-A, and typical type and frequency of recreation use taking place in the winter, there would be minimal, if any, effect on recreation opportunities from these activities. However, the presence of oil and gas winter activity could be beneficial to recreationists in the case of an emergency as a means of communication and/or medical help.

Gravel Pads, Roads, and Airstrips

As part of production activities, an airstrip, camp facilities, and a storage yard could be needed. A borrow site from which to acquire gravel for pads, roads, and an airstrip may be a part of each production operation, but depending on the availability of gravel and the proximity of production operations, some borrow sites may provide gravel for multiple production operations. The only visible disturbance associated with gravel sites from borrow pits would generally only be stockpiled materials. While these sites could be large in size or footprint (about 37 acres each), very little material would remain as stockpile at any one time. Gravel mine sites from aboveground bedrock locations may produce scenic impacts if material is removed from rock outcrops within the planning area. Airstrips would usually be located near a central processing facility for transporting supplies and personnel to the field site.

While the intensity of impacts would be greatest during actual construction and development of the roads and pads, human presence and associated activity could have impacts on recreation resources during the life of the activity. Because production could occur for 10–50 years beyond the development phase, impacts would be long-term. Impacts would be greatest within 1 mile of a road, airstrip, or gravel site, and 2 miles of a pad. The estimated long-term disturbance for central processing facilities booster pump stations, compressor stations, and staging bases in Alternative B-2 is 480 acres. The greatest impacts to recreation resources would be within 2 miles of one of these sites. The estimated disturbance for in-field gravel roads, airstrips, gravel pads, and gravel pits in Alternative B-2 is 6,269 acres. At this time, it is not known what the layout of this infrastructure would be. Assuming all roads, pads, pits, and airstrips do not overlap with other infrastructure, a 1-mile impact zone for roads, airstrips, and gravel pits, a 2-mile impact zone for pads and associated facilities, the approximate total number of acres impacting recreation resources is 2,133,652 acres.

The relative proportion of the gravel roads, airstrips, and pads to the Reserve size is minimal. Once built, the infrastructure would be used year-round. Due to the climate of the Reserve, recreationists would be more likely to see the roads in the summer than winter. However, since this infrastructure would be a part of production activities, they would most likely be off limits to the public. Displacement of recreationists from these areas would adversely affect recreationists' experiences and desired beneficial outcome (i.e., hunting, camping, hiking, etc.) from use of the public lands. However, the degree of the effect would depend on the actual location of the infrastructure; generally, infrastructure distant from routes of travel by recreationists would have little to no effect on recreationists.

The discovery and development of commercial fields is likely to occur gradually across the NPR-A. During production, there would be a production pad, which could potentially support dozens of wells and contain a large central processing facility for an oil field or a combined central processing facility and gas compressor facility for a gas field.

The central processing facility would typically include living quarters and offices, maintenance shops, storage tanks for fuel and water, power generators, waste-treatment units, a communications center, communication towers, aircraft towers and compressors for gas and water reinjection. They would be constructed as transportable modules, which would be supported above the ground on pilings to accommodate ground settling or frost heaving. Towers could be as high as 200 feet and well lit.

The oil and gas facilities, equipment, noise, night lighting, and human activity could alter the recreation setting to an industrial setting, which would interfere with recreationists' goals, and influence their opportunities, activities, experiences, and benefits. Recreation resources could be affected by possible displacement, if the activity were to take place at a site previously used for recreation. The actual effects would depend greatly on where development fields were located.

Pipelines

The production operation would include feeder lines, regional pipelines, booster pump (oil) or additional compression stations (gas), a high-pressure gas trunk line, a gas conditioning facility and an oil-sale and/or gas-sale pipeline to transport the resource to market. The actual locations of new pipelines in the NPR-A would depend on the location and sequence of commercial-sized discoveries. Aboveground pipelines for oil would be the preferred method, while gas pipelines would be underground.

Oil pipelines would create a minor visual impact to recreationists who happen to see them, for the length of time that they are in view. While gas pipelines would not be visible, vegetation over the gas pipelines would indicate their location. The dirt work involved with underground pipelines could leave a change in the vegetation (see section 4.5.5, "Vegetation") that would benefit recreationists by creating an easier walking area. Pipelines and associated human activity could alter the recreation setting to an industrial setting, which would interfere with recreationists' goals, and influence their opportunities, activities, experiences, and benefits. Once built, a pipeline would have a long-term impact on the area. Due to the climate of the Reserve and typical recreation activity and frequency in the winter, a pipeline would be more likely to be seen in the summer months than the winter months.

The estimated long-term disturbance (life of the project) for gathering or feeder lines, gas pipelines, and oil pipelines in Alternative B-2 is 1,653 acres, with 8,002 acres short-term disturbance. Short-term impacts would be minimal, temporary, and confined to the immediate area (i.e., within approximately one-half mile in any direction). Assuming a 1-mile impact zone on either side of pipelines, the total long-term impacts to recreation resources from oil and gas pipelines would be approximately 1,922,560 acres.

4.5.16.3 Effectiveness of Stipulations and Best Management Practices

Although the lease stipulations and best management practices of Alternative B-2 do not specifically address recreation resources, many of the lease stipulations and best management practices of Alternative B-1 would serve to protect recreation resources such as Best Management Practices A-1 through A-7, A-9, B-1, B-2, C-4, E-6, E-7, E-8, and F-1, and Lease Stipulations D-1, E-2, E-3, K-1, and K-2. In addition, approximately 13.35 million acres would be classified as special areas, further protecting recreation resources in the Reserve. Table 2–3 in Volume 1, Chapter 2 has a description of the stipulations and best management practices. These lease stipulations and best management practices help protect recreation resources by protecting the natural environment and the resources that recreationists may be interested in such as fish, mammals, birds, vegetation, and water.

4.5.16.4 Conclusion

The impacts from activities not associated with oil and gas on recreation resources would be minimal, seasonal, confined to the immediate area, and present only during the activity for Alternative B-2. About 581,397 acres or 61,093 miles of seasonal impacts is expected to be impacted short-term by seismic activities, 249,961 acres or 83,320 miles of short-term impacts by the construction of ice roads or airstrips and snow trails, and 912 acres by exploration and delineation wells as described in the oil and gas scenarios above. However, due to the remoteness and climate of the Reserve, and typical type and frequency of recreation use taking place in the winter, there would be minimal, if any, effect on recreation opportunity from these activities.

The approximate total number of acres impacting recreation from gravel pads, roads, and airstrips is 2,014,296 acres. Long-term acres impacted by drilling production, service wells and pipelines are approximately 2,041,921 acres (9,394 acres in the short term). These activities could displace recreationists, and thus, adversely affect their experiences and desired beneficial outcome from use of the public lands. However, the degree of the effect would depend on the actual location of the activities and their relationship to recreation opportunities. Pipelines, production activities, and associated human activity could alter the recreation setting to an industrial setting, which would interfere with recreationists' goals, and influence their opportunities, activities, experiences, and benefits.

The impacts on recreation resources would be similar for all alternatives. The biggest difference between the alternatives in relation to recreation resources is the total amount of activity that would take place under each alternative. Approximately 13.35 million acres would be designated special areas under Alternative B-2, further protecting recreation resources in the Reserve. The short-term acres impacting recreation resources are approximately 847,021 acres, seasonal 249,961 acres, and long-term 4,056,216 acres.

Long-term impacts associated with Alternative B-2 would impact the lowest amount of acres for processing facilities, booster pump stations, compressor stations and staging bases of all the alternatives. Using a 1-mile impact zone for roads, airstrips and gravel pits, and a 2-mile impact zone for pads and associated facilities, this alternative would impact the least amount of acres for recreation resources. The one-mile impact zone around oil pipelines with this alternative would also impact the least amount of acres of all the alternatives. The southern portion of the NPR-A, which has traditionally had the most special recreation permit authorizations per year, would not be available for leasing under Alternative B-2.

As the climate gets warmer in the NPR-A (Scenarios Network for Alaska Planning 2010), the timing of recreation activities would change. Summer recreation activities could take place for a longer time period and winter activities for a shorter timeframe. Warmer and longer summers could increase the demand for recreation use of the area. Climate change could affect the caribou migration patterns, which would in turn change the location of guided special recreation permit activity taking place. According to the Scenarios Network for Alaska Planning fire map, there would be an increase in fires in the southern portion of NPR-A. The fires could displace special recreation permit permittees.

4.5.17 Wild and Scenic Rivers

Under Alternative B-2, none of the 12 eligible rivers described in section 3.4.7 would be found suitable and recommended for inclusion in the National Wild and Scenic Rivers System. This is similar to the situation in Alternative D. However, in contrast to Alternative D, most of the eligible river miles would be within an area where permanent non-subsistence infrastructure would generally not be allowed. This is combined with a commitment to use existing authorities to protect outstandingly remarkable values, free flow and clean water.

This alternative provides an alternative form of protection for the 12 rivers that, in contrast to Alternative B-1, would not require management of these rivers as wild river areas so it would be significantly easier to allow roads and bridges to cross these rivers than would be the case under Alternative B-1. The river values would in general be protected, but the rivers would not be determined suitable as components of the national wild and scenic rivers system.

4.5.17.1 Activities Not Associated With Oil and Gas Exploration and Development

Free Flow and Water Quality: The 12 eligible rivers would remain free flowing and free of pollution from impacts resulting from non-oil and gas activities the same as described for Alternative B-1, because non-oil and gas activities would not be sufficient to cause noticeable impacts.

Outstandingly Remarkable Values: There are no notable impacts to outstandingly remarkable values identified for the 12 eligible rivers from non-oil and gas activities under Alternative B-2. Paleontological resources would continue to be studied and there is some chance that unauthorized removal of paleontological resources might occur at a similar level to the current situation. Studies impact a few square meters of surface, and resource theft, while it is known to occur, is uncommon, and law enforcement efforts in this area are thought to provide deterrence. Wildlife resources along the rivers might be disturbed to a very minor extent by recreational visitors and by aircraft. Recreational activity will likely continue at current levels. Recreational activities along the eligible rivers would not be noticeably impacted by other non-oil and gas activities in the area. Subsistence resources and access would not be impacted by non-oil and gas activities along the eligible streams. Scenery in the area would not be changed by non-oil and gas activities.

4.5.17.2 Oil and Gas Exploration and Development Activities

The 12 eligible rivers are in areas of low potential for exploration and development. In general, the impacts to river values under Alternative B-2 would be about the same as those described for Alternative B-1. Aircraft overflights of eligible rivers might increase from oil and gas activities, and if this happens, there might be some impact to recreation and subsistence uses. Recreation experiences would be less primitive, and subsistence hunts could be disrupted by such overflights. The likelihood permitted crossings by roads or bridges over eligible river segments, outside the area where permanent non-subsistence infrastructure is prohibited, would be much the same as under Alternative D.

4.5.17.3 Effectiveness of Stipulations and Required Operating Procedures

Best Management Practices A-2 through A-7 reduce risks to water quality impairment through procedures for handling potential pollutants, preventing spills, and responding to spills. Setbacks in K-1 should be effective in reducing potential pollution and, along with Best Management Practice E-20, will reduce visual impacts to all eligible streams. In addition, Best Management Practice C-2 would protect stream banks from compaction and E-16 would prohibit removal of more than 100 cubic yards of sand or gravel from cliffs, and any extraction of sand or gravel near streams would require studies that would indicate there would be no potential impacts to the integrity of the river bluffs. Stipulation K-12 would provide protection for the wildlife values (caribou) near the eligible rivers.

4.5.17.4 Conclusion

There would be few direct or indirect impacts to the Wild and Scenic River values of the 12 eligible rivers under Alternative B-2. The eligible river area most likely to be impacted is the lower portion of the Utukok within the planning area, which could be impacted by a potential Chukchi Sea development corridor. The lower Utukok would be available for leasing (see Table 4-20 in Volume 2) and lies within the potential Chukchi Sea development corridors under Alternative B-2.

The eligible river segments in the Utukok Uplands Special Area would be protected by closure to leasing and the general prohibition of non-subsistence permanent infrastructure; this would include Carbon Creek, the middle portion of the Utukok, the upper portion of the Colville, the lower part of the Nuka, the upper portion of the Awuna, and the upper section of the Kokolik. Adverse impacts to free flow, water quality, and outstandingly remarkable values for these three streams would be the same as under Alternative B-1.

All eligible river segments would be subject to stipulations and required operating procedures, including Required Operating Procedures A-2 through A-7, and K-1, which would reduce the potential for pollution and visual impacts. Values would be protected by stipulations and best management practices and by the fact that development or installation of infrastructure in these river areas would be prohibited in the majority of the area, and such infrastructure as would be permitted would not significantly impact the outstandingly remarkable values. There would be no significant impacts to river values of eligible rivers within the planning area as direct or indirect impacts of this alternative. Eligibility for inclusion in the National Wild and Scenic Rivers System in the future through impacts to free-flow, water quality, or outstandingly remarkable values would not be foreclosed.

Climate change might impact the vegetation and soils along the eligible streams, most noticeably by the intrusion of taller shrubs and thawing permafrost. This would impact the accessibility and scientific values of cultural sites by hiding them, and change the scenic quality of the areas viewable from the stream by limiting vistas. It is possible that melting permafrost could increase sedimentation and turbidity in these streams, reducing water quality.

4.5.18 Wilderness Characteristics

Alternative B-2 would allow leases to be offered for oil and gas exploration and development on 52 percent of NPR-A subsurface lands. Another 1.57 million acres would remain deferred from oil and gas leasing until 2014; and 425,000 acres would be deferred until 2018. There are 13.35 million acres that would be recognized as special areas (Teshekpuk Lake Special Area, Colville River Special Area, Utukok River Uplands Special Area, Kasegaluk Lagoon Special Area, and Peard Bay Special Area). Alternative B-2 would not recommend any rivers be designated as Wild and Scenic Rivers.

4.5.18.1 Activities Not Associated with Oil and Gas Exploration and Development

Under Alternative B-2, the characteristics of wilderness could be affected in the same way as Alternative A from activities not associated with oil and gas exploration and development. Alternative B-2 emphasizes the protection of surface resources of the NPR-A and portions of the Reserve would be unavailable for leasing, neither of which would change the effects of activities not associated with oil and gas as compared to Alternative A.

4.5.18.2 Oil and Gas Exploration and Development Activities

Seismic Surveys

Under Alternative B-2, there could be up to 11 seismic surveys, 5 exploration-focused and 6 production-focused, for a total estimated short-term disturbance of 581,400 acres (see Table 4-11 in Volume 2) for surveying and camp train use under Alternative B-1. The surveys use low-ground-pressure vehicles to minimize potential impacts to the tundra. The typical survey lasts about 100 days. Seismic camps, which generally consist of six camp strings of five ski-mounted trailers, are typically moved every few days to once a week. Wilderness characteristics of naturalness, outstanding opportunities for solitude or primitive and unconfined recreation, and scenic values could be minimally impacted from the moving camps and associated noise from generators, aircraft, and human presence. The impact would be minimal, temporary, and confined to the immediate area (i.e., within approximately 0.5 mile in any direction).

A longer lasting impact could be to vegetation resulting from seismic survey operations (see section 4.5.5) impacting naturalness and scenic values. The color contrast would be minimal from ground view and almost nonexistent from more than a few hundred feet away. After 8 to 9 years, the evidence of use would be minimal. Seismic operations by their nature do not follow the same routes every year and the number of miles of survey line run can vary greatly from year to year.

Ice Roads, Pads, Airstrips and Snow Trails

Ice roads, pads, airstrips, and snow trails are temporary in nature and traversed during the winter months. Ice roads provide seasonal routes for heavy equipment supplies, and movement of personnel to remote staging areas or well locations. Ice airstrips are used to transport crews and supplies to and from sites. Snow trails provide seasonal routes for use by low-ground pressure vehicles and used for moving equipment, supplies, personnel accommodations, and drill rigs capable of disassembly to components small enough for transport on such vehicles. The estimated total seasonal acres disturbed by ice roads, ice pads, airstrips, and snow trails are 249,961 acres. The wilderness characteristics of naturalness and solitude or primitive and unconfined recreation could be minimally impacted from the associated noise from generators, aircraft, and human presence. The impact would be minimal, temporary, and confined to the immediate area (i.e., within approximately 0.5 mile in any direction).

Exploration and Delineation Wells

Exploration drilling since 1999 involved no more than two drill rigs active simultaneously in the Reserve in any given season. The estimated number of drill rigs per year under Alternative B-2 for exploration/delineation is two oil rigs and three gas rigs. While a rig could be used for multiple wells, each rig could only be used at one site at a time. Typically, drill rigs are removed from the Reserve at the end of the winter drilling season. Drilled wells are either plugged or capped for reentry at a later date. Approximately 912 acres would have short-term disturbance from exploration and delineation wells under Alternative B-2. Wilderness characteristics of naturalness and outstanding opportunities for solitude or primitive and unconfined recreation could be minimally impacted from the associated noise from generators, vehicles, and human presence. The impact would be minimal, temporary, and confined to the immediate area (i.e., within approximately 0.5 mile in any direction). For well sites that are capped, a wellhead would remain on site. Due to the remoteness and expansiveness of the Reserve, a capped wellhead would not impact wilderness characteristics.

Gravel Pads, Roads, and Airstrips

As part of production activities an airstrip, camp facilities, and a storage yard could be needed. A borrow site from which to acquire gravel for pads, roads, and an airstrip may be a part of each production operation, but depending on the availability of gravel and the proximity of production operations, some borrow sites may provide gravel for multiple production operations. The only visible disturbance associated with gravel sites from borrow pits would generally only be stockpiled materials. While these sites could be large in size or footprint (about 37 acres each), very little material would remain as stockpile at any one time. Gravel mine sites from aboveground bedrock locations may produce visual impacts if material is removed from rock outcrops within the planning area. Airstrips would usually be located near a central processing facility for transport of supplies and personnel to the field site.

While the intensity of impacts would be greatest during actual construction and development of these facilities, remaining structures (i.e., roads, pads, airstrips), human presence, and associated activity and noise all would have impacts on wilderness characteristics during the life of the activity. Because production could occur for 10 to 50 years beyond the development phase, impacts to wilderness characteristics of naturalness, outstanding opportunities for solitude or primitive and unconfined recreation, and scenic supplemental values would be long term. Impacts would be greatest within 1 mile of a road, airstrip, or gravel site, and 2 miles of a production pad. The estimated long-term disturbance for central processing facilities booster pump stations, compressor stations and staging bases in Alternative B-2 is 480 acres. The greatest impacts to wilderness characteristics would be within 2 miles of one of these sites. The estimated usage for in-field gravel roads, airstrips, gravel pads, and gravel pits in Alternative B-2 is 6,269 acres. At this time, it is not known what the layout of this infrastructure would be. Assuming all roads, pads, pits and airstrips do not overlap with other infrastructure; a 1-mile impact zone for roads, airstrips, and gravel pits; a 2-mile impact zone for pads and associated facilities; the approximate total number of acres impacting wilderness characteristics is 2,133,652 acres. The BLM can require removal of gravel roads/pads/airstrips after the life of the activity, or could decide to allow them to remain forever, which would have a permanent impact on wilderness character. If these activities impair wilderness characteristics in the future, the areas would be excluded from the inventory of lands with wilderness characteristics.

The discovery and development of commercial fields is likely to occur gradually across the NPR-A. During production, there would be a production pad, which could potentially support dozens of wells and contain a large central processing facility for an oil field or a combined central processing facility/gas compressor facility for a gas field.

The central processing facility would typically include living quarters and offices, maintenance shops, storage tanks for fuel and water, power generators, waste-treatment units, a communications center, communications towers, aircraft towers and compressors for gas and water reinjection. They would be constructed as transportable modules, which would be supported above the ground on pilings to accommodate ground settling or frost heaving. Communication towers could be as high as 200 feet and well lit.

Pipelines

The production operation would include feeder lines, regional pipelines, booster pump (oil) or additional compression stations (gas), a high pressure gas trunk line, a gas conditioning facility and an a oil-sale and/or gas-sale pipeline to transport the resource to market. The actual locations of new pipelines in NPR-A would depend on the location and sequence of commercial-sized discoveries. Aboveground pipelines for oil would be the preferred method while gas pipelines would be underground. Because production could occur for 10 to 50 years beyond the development phase, impacts to wilderness characteristics of naturalness, outstanding opportunities for solitude or primitive and unconfined recreation, and scenic supplemental values would be long term. The estimated long-term disturbance from gathering/feeder lines, gas pipelines, and oil pipelines in Alternative B-2 is 1,653 acres, with 8,002 acres short-term use. Short-term impacts would be minimal, temporary, and confined to the immediate area (i.e., within approximately 0.5 mile in any direction). Assuming a 1-mile impact zone on either side of pipelines the total long-term impacts to wilderness characteristics from oil and gas pipelines would be approximately 1,922,560 acres. If these activities impair wilderness characteristics in the future the areas would be excluded from the inventory of lands with wilderness characteristics.

4.5.18.3 Effectiveness of Stipulations and Best Management Practices

Although the lease stipulations and best management practices do not specifically address wilderness characteristics and BLM is not considering recommending designation of wilderness in the planning area, many of the standards required for development of Alternative B-2 would serve to protect wilderness characteristics including best management practices A-1through A-7, B-2, C-2, C-3, E-1, E-4, E-13, and F-1,and lease stipulations D-1, D-2, G-1. In addition, approximately 15.5 million acres would be classified as special areas, further protecting wilderness characteristics in the Reserve. Table 2–3 in Volume 1, Chapter 2 has a description of the stipulations and required operating procedures/best management practices. These lease stipulations and best management practices help protect wilderness characteristics by protecting the natural environment and resources such as fish, mammals, birds, vegetation, and water.

4.5.18.4 Conclusion

The impacts from activities not associated with oil and gas on wilderness characteristics from Alternative B-2 would be minimal, confined to the immediate area, and for the most part concurrent with activities. Total short-term acres for Alternative B-2 as described in the oil and gas scenarios for seismic activities would be 581,400 acres. However, there may be evidence of the seismic activity for 8 to 9 years. About 249,961 acres is expected to be impacted by the construction of ice roads, ice pads, airstrips, and snow trails and 912 acres by exploration and delineation wells as described in the oil and gas scenarios above. The impact would be minimal, temporary, and confined to the immediate area.

The approximate total number of acres impacting wilderness characteristics from gravel pads, roads, and airstrips is 2,014,296 acres. Long-term acres impacted by drilling production, service wells and pipelines are approximately 2,041,921 acres (9,394 acres in the short term). If these activities impair wilderness characteristics in the future the areas would be excluded from the inventory of lands with wilderness characteristics.

Disturbance from long-term, seasonal and short-term actions could potentially impact approximately 4.7 million, of the NPR-A's nearly 23 million acres in a manner that could impair wilderness characteristics. Of the remaining 18.3 million acres in the NPR-A 13.35 million acres of lands with wilderness characteristics would be protected by special designation or by being unavailable for leasing and development. The balance of the lands with wilderness characteristics, 4.95 million acres, would not have measures taken to specifically protect lands with wilderness characteristics, but are not anticipated to be subject to actions that would cause wilderness characteristics to be lost.

The impacts on wilderness characteristics would be similar for all alternatives. The biggest difference between the alternatives in relation to wilderness characteristics is the total amount of activity that would take place under each alternative. After B-1, Alternative B-2 would have the least percentage of seasonal impacts, winter short term use and long-term impacts on wilderness characteristics.

The supplemental values than an area may contain of ecological, geological, or other features of scientific, education, scenic, or historical value may be affected if the climate continues to warm in the NPR-A (Scenarios Network for Alaska Planning 2010). See climate sections within the Physical Environment and Biological Resources sections of Chapter 3 for more information.

4.5.19 Visual Resources

Under Alternative B-2 the Wainwright Inlet and those areas where new non-subsistence infrastructure is not allowed would be designated Visual Resource Management Class II (37 percent of NPR-A) (Map2-5). The objective of this class is to preserve or retain the existing character of the landscape. Except for those areas designated as VRM II, rivers and lands within 3 miles of segments of rivers identified as eligible for Wild and Scenic River designation in this IAP, the 2003 Northwest NPR-A IAP, or the 2008 Northeast NPR-A Supplemental IAP; also Kasegaluk Lagoon, Peard Bay, Elson Lagoon, Dease Inlet, and Admiralty Bay and lands within 3 miles of those waterbodies would be designated as Visual Resource Management Class III (26 percent of NPR-A). This class would generally allow change to occur. The remainder of the planning would be designated Class IV (37 percent of NPR-A). The levels of change allowed for this class can be high.

4.5.19.1 Activities Not Associated with Oil and Gas Exploration and Development

Under Alternative B-2, visual resources could be affected in the same way as Alternative A from activities not associated with oil and gas exploration and development. Alternative B-2 emphasizes the protection of surface resources of the NPR-A and makes portions of the Reserve unavailable for leasing, neither of which would change the effects of activities not associated with oil and gas as compared to Alternative A.

4.5.19.2 Oil and Gas Exploration and Development Activities

Seismic Surveys

Under Alternative B-2 there could up to 11 seismic surveys, 5 exploration-focused and 6 production-focused, for a total of 581,400 acres impacted by surveying and camp train use. The surveys use low-ground-pressure vehicles to minimize potential impacts to the tundra. The typical survey lasts about 100 days. Seismic camps, which generally consist of six camp strings of five ski-mounted trailers, are typically moved every few days to once a week.

On-shore seismic surveys on the North Slope are only collected in the winter, and therefore the colors of structures and equipment would have a weak contrast with the white color of the snow-covered landscape. In Visual Resource Management terms, the definition of weak is: The element contrast can be seen, but does not attract attention (H-8431-1). Activities in the winter would be far less visible due to the limited daylight hours, although lights on equipment would be visible when the equipment is passing through an area. Due to the remoteness and climate of the Reserve, the casual observer would not likely be present to be affected visually by the seismic activity. Local subsistence users could be traveling on the tundra and observe the seismic activity (see section 4.5.13). Visual resources could be minimally impacted from the moving camps, aircraft, and human presence.

The seismic operations would have a moderate contrast to the landscape character element of line. In Visual Resource Management terms, the definition of moderate is: "The element contrast begins to attract attention and begins to dominate the characteristic landscape" (H-8431-1). The seismic equipment would represent a bold line on a large mass of continuous white.

A longer lasting visual impact could be to vegetation resulting from seismic survey operations (see section 4.5.5). Because trails visually modify existing vegetation, they would not produce much contrast to line, form, or texture. The color contrast would be minimal from ground view and almost nonexistent from more than a few hundred feet away. After 8 to 9 years, the evidence of use would be minimal. Seismic operations by their nature do not follow the same routes every year and the number of miles of survey line run can vary greatly from year to year.

Ice Roads, Pads, Airstrips, and Snow Trails

Ice roads, pads, airstrips, and snow trails are temporary in nature and traversed during the winter months. Ice roads provide seasonal routes for heavy equipment supplies, and personnel accommodations moving to remote staging areas or well locations. Ice airstrips are used to transport crews and supplies to and from sites. Snow trails provide seasonal routes for use by low-ground-pressure vehicles and used for moving equipment, supplies, personnel accommodations, and drill rigs capable of disassembly to components small enough for transport on such vehicles.

Activities in the winter would be far less visible due to the limited daylight hours, although lights on equipment would be visible when the equipment is passing through an area. Due to the remoteness and climate of the Reserve the casual observer would not likely be present to be affected visually by this activity. Local subsistence users could be traveling on the tundra and observe the activity (see section 4.5.13). Visual resources could be minimally impacted from the moving camps, aircraft, and human presence. The estimated total seasonal acres impacted by ice roads, ice pads, airstrips, and snow trails are 249,961 acres.

Exploration and Delineation Wells

Exploration and delineation wells are typically drilled in the winter in the Reserve. Exploration drilling that has taken place since 1999 involved no more than two drill rigs active simultaneously in the Reserve in any given season. The estimated number of drill rigs per year under Alternative B-2 for exploration/delineation is two oil rigs and three gas rigs. While a rig could be used for multiple wells, each rig could only be used at one site at a time. Typically, drill rigs are removed from the Reserve at the end of the winter drilling season. Drilled wells are either plugged or capped for reentry at a later date. Capped wells have a pipe, which would likely be less than 6 feet tall and surrounded by a short fence 6 feet square. The pipe could be a long-term impact, but would be almost unnoticeable from several hundred feet away. Approximately 912 acres would have short-term impacts from exploration and delineation wells under Alternative B-2.

Activities in the winter would be far less visible due to the limited daylight hours, although lights on equipment would be visible when the equipment is passing through an area. Due to the remoteness and climate of the Reserve the casual observer would not likely be present to be affected visually by this activity. Local subsistence users could be traveling on the tundra and observe the activity (see section 4.5.13). Visual resources could be minimally impacted from the moving camps, aircraft, and human presence.

Gravel Pads, Roads, and Airstrips

As part of production activities, an airstrip, roads, camp facilities, and a storage yard could be needed. A borrow site from which to acquire gravel for pads, roads, and an airstrip may be a part of each production operation, but depending on the availability of gravel and the proximity of production operations, some borrow sites may provide gravel for multiple production operations. The only visible disturbance associated with gravel sites from borrow pits would generally only be stockpiled materials. While these sites could be large in size or footprint (about 37 acres), very little material would remain as stockpile at any one time. Gravel mine sites in the NPR-A from aboveground bedrock locations may produce visual impacts if material is removed from rock outcrops. This mining activity would change the form of the natural landscape and may be visible from the Foreground-Middleground Zone. Airstrips would usually be located near a central processing facility for transport of supplies and personnel to the field site.

While the intensity of impacts would be greatest during actual construction and development of the roads and pads, human presence, and associated activity could also have impacts on visual resources during the life of the activity. The landscape of the Reserve is homogeneous, without a lot of visual variety and contrast. Therefore, building a road would be expected to cause a weak amount of contrast to the form of the land. It would minimally impact the landscape character element of line through introduction of the location and road, both of which would be visible linear features. Exposing the soil would cause a weak impact to the color in the landscape. The texture of the exposed soil would be smoother than the existing landscape, thus creating a weak contrast. When an application is received for a road, a visual contrast rating would be completed to determine the actual contrast, along with a visual simulation and mitigation measures would be determined to maintain the appropriate Visual Resource Management class.

Because production could occur for 10 to 50 years beyond the development phase, impacts would be both short term and long term. These impacts would be greatest within 1 mile of a site. The estimated use for in-field gravel roads, airstrips, gravel pits, and gravel pads in Alternative B-2 is 5,554 acres. The estimated long-term use for central processing facilities booster pump stations, compressor stations and staging bases in Alternative B-2 is 480 acres. The greatest impacts to visual resources would be within 2 miles of one of these sites. At this time, it is not known what the layout of this infrastructure would be. Assuming all roads, pads, pits and airstrips do not overlap with other infrastructure, a 1-mile impact zone for roads, airstrips, and gravel pits, a 2-mile impact zone for pads and associated facilities, the approximate total number of acres impacting visual resources is 2,133,652 acres (see Table 4-14 in Volume 2).

The relative proportion of the roads, airstrips, and pads to the Reserve size is minimal. Once built, they would be used year-round. Due to the climate of the Reserve, the casual observer would be more likely to be in the Reserve to see the roads in the summer than winter. The impact associated with the graveled pads and roads would be moderate, long term, and confined to the 1- and 2-mile impact zones.

The discovery and development of commercial fields is likely to occur gradually across the NPR-A. During production, there would be a production pad, which could potentially support dozens of wells and contain a large central processing facility for an oil field or a combined central processing facility/gas compressor facility for a gas field. The central processing facility would typically include living quarters and offices, maintenance shops, storage tanks for fuel and water, power generators, waste-treatment units, a communications center, communication towers, aircraft towers and compressors for gas and water reinjection. They would be constructed as transportable modules, which would be supported above the ground on pilings to accommodate ground settling or frost heaving. Communication towers could be as high as 200 feet and well lit.

The blocky, rectangular form of the structures would contrast strongly with the existing landscape. In Visual Resource Management terms, the definition of strongly is: The element contrast demands attention, will not be overlooked, and is dominant in the landscape (H-8431-1). They would introduce distinct vertical lines, which would strongly contrast with the existing horizontal landscape. The smooth texture of the structures would strongly contrast with the coarser texture of the surrounding vegetation. Potential impact would include artificial light and associated sky glow from winter drilling. This lighting would degrade scenic quality by introducing intrusive, artificial lighting into an otherwise unlit natural landscape that would be visible from a distance of approximately 17 miles (based on a 200 feet tall tower calculated mathematically).

Visual resources would be moderately impacted in the long term, and confined to the area of view. The actual effects would depend greatly on where development fields were located.

Pipelines

The production operation would include feeder lines, regional pipelines, booster pump (oil) or additional compression stations (gas), a high-pressure gas trunk line, a gas conditioning facility, and an oil-sale and/or gas-sale pipeline to transport the resource to market. The actual locations of new pipelines in the NPR-A would depend on the location and sequence of commercial-sized discoveries. Aboveground pipelines for oil would be the preferred method while gas pipelines would be underground.

Building a pipeline would cause a strong amount of contrast to the form of the land. It would moderately impact the landscape character element of line through introduction of the location and pipeline, both of which would be visible linear features. Exposing the soil would cause a weak impact to the color in the landscape. The texture of the exposed soil would be smoother than the existing landscape, thus creating a weak contrast. Once the pipeline is built, it would have a moderate contrast with the form of the land. The NPR-A has many lakes of various sizes and shapes. A pipeline crossing the lakes would create a moderate contrast. The color contrast would depend on the color of the pipeline. Assuming the pipeline is grayish silver, there could be a moderate contrast with the colors in the landscape. The texture of the pipeline would be smooth compared to the existing landscape.

Once built, a pipeline would have a long-term impact on the area, being more visible in the summer months than the winter months. The estimated long-term disturbance for gathering/feeder lines, gas pipelines, and oil pipelines in Alternative B-2 is 1,653 acres, with 8,002 acres short-term use. Assuming a 1-mile impact zone on either side of pipelines the total long-term impacts to visual resources from oil and gas pipelines would be approximately 1,922,560 acres. Visual resources would be moderately impacted long term, but confined to the immediate area. The actual effects would depend greatly on where development fields were located.

4.5.19.3 Effectiveness of Stipulations and Best Management Practices

Best management practice E-20 will assist in the protection of visual resources by requiring applicants for construction of permanent facilities to submit a plan to minimize visual impacts consistent with the Visual Resource Management classes adopted in the plan. This best management practice is unique to Alternative B-2. Other lease stipulations and best management practices would serve to protect visual resources, including A-1 through A-7, C-2, C-3, E-1, E-5, and E-15, and lease stipulations D-1, D-2, and G-1, by regulating overland moves, seismic work, exploratory drilling, facility design, construction and siting of facilities, water use, minimize impacts to solid and hazardous waste, minimize contaminants and the protection of streambanks. In addition, approximately 13.35 million acres would be classified as special areas under Alternative B-2, further protecting visual resources in the Reserve. Table 2–3 in Volume 1 has a description of the stipulations and best management practices. These lease stipulations and best management practices help protect visual resources by protecting the natural environment and resources such as fish, mammals, birds, vegetation, and water.

4.5.19.4 Conclusion

Under Alternative B-2, the impacts from activities not associated with oil and gas on visual resources would be minimal, confined to the immediate area, and for the most part concurrent with activities. About 581,400 acres is expected to be impacted by seismic activities, which for the most part would be minimal, temporary, and confined to the immediate area. However, there may be evidence of the seismic activity for 8 to 9 years. About 249,961 acres is expected to be impacted by the construction of ice roads, ice pads, airstrips, and snow trails, and 912 acres by exploration and delineation wells as described in the oil and gas scenarios above. The impacts of the construction of ice roads/ airstrips and snow trails, drilling of exploration and delineation wells, would be minimal, temporary, and confined to the immediate area.

The approximate total number of acres impacting visual resources from gravel pads, roads, and airstrips is 2,014,296 acres. Long-term acres impacted by drilling production, service wells and pipelines are approximately 2,041,921 acres (9,394 acres in the short term).

The impact to visual resources from gravel pads, roads, and drilling production, service wells and pipelines would be moderate long term, and confined to the 1- and 2-mile impact zones. When an application is received for these kinds of activities a visual simulation will be conducted for the NEPA analysis for each project, which will determine the actual impact expected. A visual contrast rating would also be completed and mitigation measures would be determined to maintain the appropriate Visual Resource Management class.

Climate change could affect visual resource values by altering the current conditions of color, vegetation, adjacent scenery, and the presence of water. Shifts in public sensitivity could occur as well. The biggest difference between the alternatives is the total amount of activity that affects visual resources, because all the alternatives would have similar types of impacts. Alternative B-2 would offer the least amount of lands for oil and gas leasing after Alternative B-1. Disturbance from long-term, seasonal, and short-term actions could potentially impact visual resources on approximately 4.7 million of the NPR-A's nearly 23 million acres. Approximately 13.35 million acres would be included in Special Areas under Alternative B-2, further protecting visual resources in the Reserve. The acres impacted with this alternative are the least of any alternative, after B-1. The Visual Resource Management classes determined in Alternative B-2 would create more lands in Class II and less Class III, than the visual resources inventory and the same amount in Class IV.

Table 4-21 in Volume 2 provides a comparative analysis between the percent of the acres of inventory class versus the percent of the acres of Visual Resource Management classes.

4.5.20 Economy

4.5.20.1 Activities Not Associated with Oil and Gas Exploration and Development

Impacts of non-oil and gas activities are likely to be the same as those for Alternative A. The BLM's estimates of trips and number of participants remains the same (Table 4-1 in Volume 2). Employment is expected to remain the same, largely occurring outside the North Slope Borough. Special recreation permit revenues are expected to remain the same as Alternative A, at a minimum of $600 per year.

Other activities such as research or surveys, various ground activities, and aircraft use not related to petroleum are shown in Table 4-1 in Volume 2, and those related to offshore petroleum are discussed later in section 4.2.1.1. North Slope Borough residents may be employed in some of these activities, as will other Alaskans and non-residents. It is possible that less research will occur as the result of less stress to targeted species and areas by oil and gas activities and possible budget constraints within the federal government in the coming decade. The lower revenues (see section 4.4.20.2 in Volume 2) for State and local government may result in fewer field activities within the NPR-A, as well.

4.5.20.2 Oil and Gas Exploration and Development Activities

In Alternative B-2, activities will begin and proceed in a manner and order similar to Alternative A. Discovered resources in the Mooses Tooth and Bear Tooth units and at Umiat will be unchanged from Alternative A. Peak production for the undiscovered resources in this alternative is calculated at 46 thousand barrels of oil per day for oil and 1.28 billion cubic feet per day for gas. Oil production will contribute to maintain TAPS throughput above threshold for nearly three years at peak production, assuming a 270,000 barrels per day threshold and a six percent production decline rate. Up to 8 oil and 21 gas processing facilities will be in operation during the life of the undiscovered fields.

Revenues

Revenues are lower than in other alternatives as the result of the smaller amount of undiscovered resources available for development and higher facilities cost per barrel of oil equivalent production for all alternatives except A. Bonus bids generated in leasing may total as much as $108 million, reflecting an anticipated lower level of leasing in available northwestern areas because of the surface occupancy (pipeline) limitations in the Teshekpuk and Utukok River Special Areas. Exploration, development, and production activities for the undiscovered resources are estimated to generate property tax revenue to the North Slope Borough of about $2.5 billion over the period, which is lower than all other alternatives except B-1. Totals of State, and federal revenues are anticipated to be less under this alternative than under all other alternatives. The estimated royalty payment shared equally by the State of Alaska and the federal government is $9.1 billion. State corporation taxes will be $0.8 billion, and federal income tax will be $6.8 billion. In addition, State production taxes are estimated to total $2.7 billion. These estimates are based upon prices of $180 per barrel of oil and $8.67 per thousand cubic feet of gas, as explained in section 4.2.1 in Volume 2.

Total revenue data, including discovered and undiscovered resources, are presented in Table 4-27. Local, State, and federal government revenues total $34 billion for all the activities, and would average $1.2 billion if all occurrences are developed simultaneously.

Employment

In this alternative, employment related to the undiscovered resources will be lower than in other alternatives except B-1, as the result of less oil and gas development. For the undiscovered scenario, 8 oil and 21 gas processing facilities would be constructed, with fewer wells drilled and fewer miles of pipeline constructed than in the other alternatives. Table 4-28 presents new and continued employment estimates for both discovered and undiscovered oil and gas activities.

Table 4-27. Alternative B-2 revenues (in millions of 2010 dollars)

	North Slope Borough		**State of Alaska**		**Federal**	
	Total	**Average annual***	**Total**	**Average annual***	**Total**	**Average annual***
Bonus bids**			54	1.8	54	1.8
Royalty			6,710	233.5	6,710	233.5
Property tax	2,920	100.0	325	11.0		
Corporate income tax			1,101	38.0	9,250	314.0
Production tax			6,837	234.0		
Totals	**2,920**	**100.0**	**15,027**	**518.3**	**16,014**	**549.3**

* If all projects occur simultaneously.
** Over next 30 years.

Table 4-28. Potential employment under Alternative B-2

	Alternative total	**Annual average**
Total for all places of residence	429,745	9,398
Direct	178,720	3,832
Indirect & Induced	251,025	5,566
North Slope Borough total	16,182	386
Direct	8,730	207
Indirect & Induced	7,452	179
Other Alaska total	337,821	7,358
Direct	125,311	2,667
Indirect & Induced	212,510	4,691
Outside Alaska total	76,104	1,654
Direct	44,681	958
Indirect & Induced	31,423	696

Other Effects of Oil and Gas Development

Under Alternative B-2, if health problems arise due to air or water pollution, or increased stress or other pathologies described in section 3.4.12, "Public Health" (Volume 1), there would be increased economic costs both for individuals and government associated with concerns such as health care, social services, and law enforcement. These costs will be less than under other alternatives.

Development under Alternative B-2 could also contribute to some increase in the cost of engaging in subsistence activities. Costs would include fuel, supplies, equipment, and additional time, particularly as travel is increased. These costs would be less than under other alternatives.

Alternative B-2 is not likely to affect the cost of fuel or supplies for villages resulting from the operation of ice roads. The chief executive officer of Kuukpik Corporation stated he could not see changes in economies resulting from the operation of ice roads. (Chinn 2007) Unless there is a gravel road connecting Nuiqsut or other North Slope villages to the state's road network, which is not anticipated as part of this IAP/EIS, it is unlikely that costs would change significantly.

With the possible exception of services related to health, social services, and law enforcement noted above, public infrastructure costs, including schools and local airports, are not likely to be affected by development under Alternative B-2. North Slope oil fields are largely self-sufficient for emergency services and health and social services. For example, oil facilities typically include emergency medical technicians, clinical facilities, and emergency transportation. Air traffic from oil and gas development will be directed toward oil field airstrips, not community airports. Local tax revenues will be lower, which may limit the Borough's ability to maintain some infrastructure or provide some services, depending on other revenue sources.

4.5.20.3 Conclusion

Employment is lower under Alternative B-2 than under all alternatives except B-1. Governmental revenues generated by oil and gas exploration and development would be lower in Alternative B-2 than under other alternatives. Lower employment and revenues are the result of lower levels of production, and lower revenues are exacerbated by higher production costs per barrel of oil equivalent than under other alternatives except A. Oil and gas exploration and development would benefit the local, State, and national economy by increasing revenues and employment. Nearly $34 billion would flow to all levels of government. There would be $16 billion for the federal government, $15 billion for the State of Alaska and $2.9 billion for the North Slope Borough. The number of jobs created by exploration, development, and production would total 429,745 direct and indirect over the life of all projects. An average of 386 North Slope Borough resident jobs would be added or continued if discovered and undiscovered resources were developed simultaneously. Increased costs to harvest subsistence resources could affect the economic well-being of North Slope Borough residents, primarily through increased costs to reach subsistence resources, but this effect would be the second lowest of all alternatives.

4.5.21 Public Health

The activities not associated with oil and gas exploration and development are described in section 4.2.1.1 in Volume 2 and include aircraft use, river trips and other recreational uses, site cleanup and remediation activities, overland moves, archeological surveys and site work. The level of such activity will be the same under Alternative B-2 as it is under Alternative A.

Such activities should not have a significant impact on public health. Localized impacts on subsistence are likely, primarily as a result of displacement of animals due to aircraft noise. In addition, the presence of temporary camps may affect subsistence regardless of whether they cause displacement of animals, as a result of the avoidance of the area by hunters seeking to minimize conflict. These impacts are described in section 4.5.13. The effect of such activities is likely to be localized and temporary.

Alterations in the success of subsistence activities can impact health by way of nutritional outcomes and risk of injury. The mechanisms of these effects are described in section 4.3.21.2 in Volume 2. For any individual affected, the impact of an unsuccessful hunt or an accident or injury on the land could be severe. However, given the transient and highly localized nature of these activities, it is unlikely that they will have any overall impact on public health.

4.5.21.1 Oil and Gas Exploration and Development Activities

The oil and gas exploration activities described in section 4.2.1.2 of Volume 2 may lead to alterations in public health and safety via a number of different pathways. These include: diet and nutrition; environmental exposures; infectious disease; safety; acculturative stress; economic impacts; and capacity of local health care services. For details of these pathways and a description of how they impact health, see section 4.3.21.2 in Volume 2. The potential impacts of Alternative B-2 on each pathway are described below.

Diet and Nutrition

The likelihood of impacts to subsistence harvests under Alternative B-2 is discussed in section 4.5.13. As is the case with Alternative A, Nuiqsut, Atqasuk, and Barrow would be the most heavily impacted communities, as these villages obtain most of their non-marine traditional food from the affected lands. Wainwright and Anaktuvuk Pass will be affected to a lesser degree, as they depend somewhat on fish and caribou harvested from potentially affected areas within the NPR-A. Any reductions in the success of the harvests of these species in any village would accelerate the transition from subsistence resources to store-bought foods, worsening nutritional outcomes and food insecurity. The emphasis of protection of surface resources under Alternative B-2, including calving and insect-relief areas for the Western Arctic caribou herd and not allowing permitting of new non-subsistence permanent infrastructure in the vast majority of the Western Arctic Herd habitat within the NPR-A, will help protect subsistence activity and will reduce the likelihood and severity of these health impacts. In particular, the expansion of protected areas close to Barrow will help lessen impacts related to competition with subsistence uses.

Nuiqsut hunters, who already avoid large areas of traditional land to the northeast of the village, could experience further limitation in their access to lands to the south and west of the village if further development occurs in the vicinity of the village. Avoidance of productive land may reduce harvests and exacerbate dietary and nutritional outcomes independent of any direct impact on the animals themselves. Making large amounts of productive land to the northwest of Nuiqsut unavailable for leasing and forbidding permanent non-subsistence infrastructure there, however, makes the likelihood of such outcomes less likely in Alternative B-2.

Environmental Exposures

Health effects from environmental exposures under Alternative B-2 will follow the same pathways as for Alternative A, described in section 4.3.21 in Volume 2. The overall impact of air quality on human health is likely to remain low. However, people who are particularly vulnerable to respiratory problems (such as children, the elderly, and people with certain chronic illnesses) may experience health problems at locations or during episodes with poorer air quality. Water contamination from runoff, spills or discharges is unlikely to cause health effects under Alternative B-2. However, if water contamination reaches a drinking water supply for residences or people on the land, acute or chronic health effects may ensue, depending on the nature of the contaminant and the level and duration of exposure. In absence of a major accidental release, contaminant levels in traditional foods are likely to remain below levels that would trigger public health concern. Environmental noise may cause annoyance or sleep disturbance for those who experience it; this is most likely to be people on the land or in cabins who are affected by helicopter traffic or overflights.

Insofar as Alternative B-2 limits development across a significant portion of the NPR-A and limits conflict between subsistence and industrial uses of the land, both real and perceived environmental exposures are likely to be lower with this alternative than with Alternatives C, and D. Intermittent exposure is possible in areas where development and subsistence use overlap. Permanent facilities in close proximity to villages may episodically affect air quality and are likely to undermine confidence in the safety of traditional foods.

Infectious Disease

Under Alternative B-2, as with Alternative A, a continued in-migration of oil industry workers from communities outside of the North Slope will present a risk of infectious disease transmission. The character and extent of this impact will be the same for all alternatives, varying only to the degree to which individual project characteristics increase the number of outside workers and the degree to which they fraternize with the local population. The nature of this impact is described in section 4.4.21.2 in Volume 2.

Safety

Safety impacts under Alternative B-2 will be similar to those for Alternative A. The main impact on safety will result from local alterations in travel patterns for subsistence activity. Noise from overflights in any area of exploration or development will cause temporary displacement of caribou and birds, and may require hunters to travel farther from their camps and cabins. These impacts will be localized and temporary, but may intermittently impact a large number of users of the land, particularly in the northeast region of the NPR-A where exploration and development is most likely to occur. The protection of surface lands under Alternative B-2 will minimize this impact for many hunters from Barrow, Atqasuk, and Nuiqsut.

Under all alternatives, any further development of fixed facilities in areas of traditional use is likely to result in voluntary displacement of subsistence. Given the current impact of Alpine on the land use patterns of Nuiqsut hunters, any further development in close proximity to that community will substantially increase their travel distances and the subsequent risk of injury.

Acculturative Stress

Under Alternative B-2, as with Alternative A, the current trends in acculturation and its subsequent health impacts are likely to continue. The emphasis on protection of surface resources under Alternative B-2 compared with Alternatives A, C, and D will help maintain subsistence and other traditional uses of the land in all communities, and will slow the rate of acculturation and subsequent health impacts.

Under all alternatives, the isolation of outside workers into segregated work camps and the low levels of direct Iñupiat employment in the oil and gas industry will continue to provide some protection against acculturative stress. Villages where industrial activity occurs in close proximity will be at greatest risk, particularly if there is more open access between the local population and the work camps.

Economic Impacts

Health impacts from economic conditions are likely to be similar under all alternatives. Revenue to the North Slope Borough, and village corporations will allow for the continued funding of existing health and social programs and the preservation of the current high level of indirect employment. New jobs in the oil and gas sector will continue to be created, though too few will go to Iñupiat workers to create any local health benefit. Increases in alcohol, drug use, and sexually transmitted infections will be expected, commensurate with the level of economic growth and the degree of contact between outside workers and local populations.

Health Care Services

The impact on health care services under Alternative B-2 will be largely the same as under Alternative A (see section 4.3.21.2 in Volume 2). Tax revenues from ongoing exploration and development will support the continued provision of the current level of health care services in the North Slope Borough, and should not significantly impact demand. Increased occurrences of injury and trauma (see safety, above) will be sporadic and will be well within the capacity of acute care and search and rescue services in Barrow. The likelihood of an increase in demand for health care services under Alternative B-2 is low. These impacts are described in section 4.5.21. Although budgetary constraints for health care services are possible, it is unlikely that these will result in significant changes in public health.

4.5.21.2 Effectiveness of Stipulations and Required Operating Procedures

The management actions described in section 2.2 and the stipulations and best management practices described in section 2.8 (both in Volume 1) provide a number of important protections for public health and safety.

Public Health Consultation, which is provided as a management action, and the Healthy Neighbor Policy (see section 2.7 in Volume 1) both recognize the importance of proper consideration of public health impacts, and engagement with local health stakeholder organizations to plan for avoiding, minimizing, and mitigating potential health harms and—where possible—enhancing health benefits. As many of the public health impacts of oil and gas development will be project-specific, such management actions are crucial.

The specific stipulations and best management practices that will directly work to protect or promote public health and safety are listed under Alternative A in section 4.3.21.3 in Volume 2. These include:

Measures affecting diet & nutrition

- A1-12: Waste Prevention, Handling, Disposal, Spills and Public Safety. (Note: A-12 applies uniquely to this alternative.)
- E-1, E-7: Facility Design and Construction
- H1-H3: Subsistence Consultation for Permitted Activities.

Measures affecting environmental exposure

- A1-12: Waste Prevention, Handling, Disposal, Spills and Public Safety. (Note: A-10(g) and A-12 apply uniquely to this alternative.)

Measures affecting infectious disease

- A1-11: Waste Prevention, Handling, Disposal, Spills and Public Safety.
- I-1: Orientation Programs Associated With Permitted Activities.

Measures affecting safety

- A1-11: Waste Prevention, Handling, Disposal, Spills and Public Safety.

Measures affecting acculturative stress

- E-13: Facility Design and Construction.

Measures affecting economic impacts on health

- I-1: Orientation Programs Associated With Permitted Activities.

When considering the effectiveness of stipulations in mitigating public health effects, it must be recognized that because the Iñupiat people continue to value this land deeply as a foundation of well-being and culture, any stipulation that contributes to minimizing the environmental impacts of development and preserving and promoting traditional uses of the land can be seen as contributing positively toward overall well-being and public health.

Taken in whole, the stipulations provide for important provisions that will directly and indirectly promote public health and safety during oil and gas development activities, and partially mitigate some of the adverse health pathways anticipated under Alternative B-2.

4.5.21.3 Conclusion

Under Alternative B-2, the pattern of health impacts is likely to be similar to Alternative A. The transition in the burden of disease from one in which infectious disease predominated to one in which chronic disease is the primary driver of ill-health will progress among the Iñupiat as it has in other indigenous populations. As is the case with other subsistence-dependent Arctic regions, injuries and trauma will continue to carry a disproportionate share of morbidity and mortality when compared to the general Alaska and U.S. populations, and the risk of injury and trauma may also be exacerbated if climate change results in unusual or unpredictable weather, water, snow, and ice conditions that make travel more hazardous (Brubaker 2011), and dislocation of subsistence species require people to travel greater distances to find marine or land mammals or edible plants.

Oil and gas activities contribute to these trends and impact public health in a number of ways. The preservation and promotion of traditional uses of the land is a public health priority, both for the nutritional benefits associated with a subsistence diet and for the social cohesion and cultural value associated with traditional Iñupiat practices. Though economic development provides important health benefits through both individual employment and revenues to local governments, these benefits are balanced against the risks that result from an erosion of traditional culture and diet, and exposure to environmental contaminants, social ills, and infectious disease. The focus on the protection of surface resources under Alternative B-2 will help preserve subsistence uses of the land and prevent erosion of traditional Iñupiat culture and diet.

Under Alternative B-2, as is the case with all alternatives, localized exploration activity will create transient impacts on subsistence by way of diversion of hunters and animals. In addition, noise from air traffic and other sources will create a nuisance around individuals' camps and cabins. Fewer hunters will be affected by such impacts under Alternative B-2, due to the larger area of heavily frequented land that will be unavailable for leasing. Potential contamination of food and surface water is possible, though measurable public health impacts resulting from such contamination are unlikely under normal operating conditions. Less conflict between development and subsistence use under Alternative B-2 will further minimize the likelihood of environmental contamination, and should reduce the likelihood of an exacerbation in the currently high levels of perceived contamination in the region.

Fixed production sites, particularly those in the vicinity of villages and in areas of heavy subsistence use of the land, will have an impact on public health under Alternative B-2. The avoidance of developed areas by hunters increases travel times and costs associated with subsistence activity, and as a result, will potentially decrease harvests and increase the risk of injury and accidents while on the land. Episodes of poor air quality associated with dust or emissions will pose a health hazard for at-risk populations such as those suffering from chronic obstructive pulmonary disease or asthma. The land-use framework under Alternative B-2 offers fewer locations where such conflicts will occur.

The economic impact of activity under Alternative B-2 may result in some reductions in funding and difficulty maintaining the current levels of services and indirect employment, particularly through the North Slope Borough. It is unlikely that budgetary constraints will have a significant impact on public health. Employment for the Iñupiat in the oil and gas sector will not likely be sufficiently large to create any positive public health impacts at a population level. The potential health risks associated with economic growth and in-migration, namely increased use and access to alcohol and drugs and the spread of infectious disease and sexually transmitted diseases will be commensurate with the level of employment, road access, and the degree to which outside workers fraternize with local populations. As with all alternatives, the continued focus on the development of isolated work camps will temper these impacts. The lower overall level of activity under Alternative B-2 will further minimize any potential negative impacts of in-migration and economic growth.

4.5.21.4 Potential New Mitigation Measures (new best management practice)

The objective and requirement/standard for potential new public health mitigation measures would be the same as those described in section 4.3.21.5, with two exceptions:

> **Exception 1.** Potential Mitigation Measure 7, which has been adopted as a Best Management Practice for Alternative B-2 only (see Best Management Practice A12 in Table 2-3).
>
> **Exception 2.** Potential Mitigation Measure 6, item c has been adopted as a Best Management Practice for Alternative B-2 only (see Best Management Practice A10f in Table 2-3).

The potential benefits and residual/unavoidable impacts for the remaining potential new mitigation measures would be similar to those described for Alternative A at section 4.3.21.5 in Volume 2.

Section 4.6:

Impacts of Alternative C

4.6 Alternative C

4.6.1 Air Quality and Climate

This section qualitatively describes the potential air quality impacts associated with Alternative C.

4.6.1.1 Activities Not Associated With Oil and Gas Exploration and Development

Air quality impacts associated with these activities are the same as those associated with Alternative A, discussed in section 4.3.1.1 in Volume 2.

4.6.1.2 Oil and Gas Exploration and Development Activities—Air Pollutant Emission Sources

The air pollutant emission sources and effects of air pollution are the same as those associated with Alternative A, discussed in section 4.3.1.2 in Volume 2.

Development and production activities can also produce fugitive dust emissions (primarily as PM_{10}). Fugitive dust occurs primarily during the summer months due to driving on unpaved roads. Vehicles can also track out fine material from gravel mining operations in the winter and summer months. Potential control measures include limiting vehicle speeds, and treating problematic road sections with surfactants or water.

Well closure, abandonment, and reclamation activities would emit air pollutants similarly to those during development (construction), since similar vehicles and other emission sources would be used. Because closure activity would not occur at a single location for any substantial length of time, the impact of air emissions at any single location would likely be short term. Impacts could be minimized by leaving gravel on-site, limiting the amount of transport. Once reclamation is complete, production facilities would no longer impact air quality in the planning area (USDOI BLM 2008).

4.6.1.3 Effectiveness of Stipulations and Best Management Practices

Best Management Practice A-9 requires that all oil and gas operations that burn diesel fuels use ultra-low sulfur diesel as defined by the Alaska Department of Environmental Conservation-Division of Air Quality. Effective December 1, 2010, the Alaska Department of Environmental Conservation adopted the EPA regulation that requires the use of ultra-low sulfur diesel fuel in all vehicles and equipment. This requirement would apply to all BLM-authorized oil and gas operations (including contractor vehicles and equipment).

Best Management Practice A-10 would provide substantial protection for air quality within the NPR-A. Pre- and post-project ambient air quality monitoring would provide an understanding of air quality in the NPR-A relative to standards and thresholds. Air quality modeling would provide an estimate of potential post-project impacts and could provide guidance on the most effective pollution control strategies to employ once the project is completed.

Consistent with 40 CFR Part 69, beginning on December 1, 2010, the diesel fuel that is designated for use in rural Alaska for all on-road and non-road vehicles and equipment, locomotive, and marine will be ultra-low sulfur diesel fuel (15 parts per million sulfur). Ultra-low sulfur diesel was designated for use for on-road vehicles in urban Alaska on October 15, 2006; for non-road vehicles and equipment on December 1, 2010; and will be designated for locomotive and marine vehicles on December 1, 2012. Urban Alaska is defined as those geographical areas of Alaska designated by the State of Alaska as being accessible by the Federal Aid Highway System. Areas not accessible by the Federal Aid Highway System are considered rural (Elson 2011).

As a trace constituent in diesel fuel, sulfur compounds may cause adverse air quality impacts through formation of sulfate particulate matter (affecting visibility) and deposition of acidic aerosols. These impacts would be reduced significantly by utilizing ultra-low sulfur diesel fuel. In addition, ultra-low sulfur diesel fuels burn cleaner and produce less light absorbing carbon particulate matter (soot, also called black carbon). When burned, ultra-low sulfur diesel emissions are much lower than those generated by previous fuels, reducing fine particulate (soot), sulfuric acid, and sulfate (visibility) impacts.

4.6.1.4 Conclusion

Exploration, development, and production activities are expected to cause increases in the concentrations of criteria pollutants, hazardous air pollutants, volatile organic compounds, and greenhouse gases. Air quality impacts from Alternative C are expected to be higher than alternatives A, B-1, and B-2 due to more federally owned subsurface being available for oil and gas leasing, and lower than Alternative D due to substantially less federally owned subsurface being available for oil and gas leasing. As a result, air pollution would be proportionately increased compared to alternatives A, B-1, and B-2, and proportionately decreased compared to Alternative D.

For a discussion of air quality modeling analyses, see section 4.3.1.4 in Volume 1 and Appendix H. The BLM modified best management practice A-10 in the Final IAP/EIS to better address potential air quality impacts.

4.6.2 Paleontological Resources

4.6.2.1 Activities Not Associated With Oil and Gas Exploration and Development

Under Alternative C, the types of non-oil and gas activities would be the same as those described for the no-action Alternative, Alternative A (section 4.3.2.1 in Volume 2), and the potential impacts to paleontological resources would be the same.

4.6.2.2 Oil and Gas Exploration and Development Activities

Effects of Seismic Surveys

Under Alternative C, the level of seismic activity is anticipated to increase moderately over that of Alternative A (section 4.3.2.2 in Volume 2). The increase could be as much as 18,316 survey/camp train miles, about 32 percent, and 180,788 surveying/camp train acres, about 34 percent. However, as previously discussed, given the low probability of impact from seismic activity, this is not regarded as a meaningful increase in terms of potential impact to paleontological resources. Therefore, the probability of encountering and impacting scientifically significant paleontological material under Alternative C remains low.

Effects of Short-term Disturbance: Exploration and Delineation Drilling

Short-term impact-producing activities include drill pads, roads, and airstrips constructed of ice and snow. Under Alternative C, it is anticipated that gas well drilling and delineation activities would increase moderately, causing significant increases in the construction of associated ice and snow infrastructure. Overall, this activity would increase to about 434,000 acres, or 33 percent more than Alternative A (section 4.3.2.2 in Volume 2). Despite the increase in acreage, the potential impacts to paleontological resources remain low, as modern exploration and delineation activities historically have had little impact on the resource.

Effects of Long-term Disturbance: Development of Oil and Gas Infrastructure

Compared to Alternative A the amount of potential disturbance to paleontological resources from construction of central processing facilities and associated satellite pads, roads, airstrips, pump/compressor stations, and gravel pits would be increased to about 15,300 acres more than 5,400 acres (54 percent). About 52 million cubic yards of gravel would be mined, an increase of about 12 million cubic yards (30 percent). Also, by comparison, the number of potential vertical support members is the same, while gas pipeline trenching would increase by 1,278 miles, under Alternative C, nearly doubling the amount and potentially adding slightly more than 5.1 million cubic yards to the total of excavated material. While the area of potential impact has increased, the level of potential impact would be relatively low.

Effects of Oil Spills and Gas Releases

Under Alternative C, the effects of spills on paleontological resources would be similar to Alternative A (section 4.3.2.2 in Volume 2). Although the area of potential impact has increased, the level of potential impact remains low. As previously described, there would probably be no adverse effect on paleontological resources from a gas release.

Effects of Abandonment and Reclamation

Abandonment and reclamation of short-term and long-term infrastructure, under most circumstances, would have limited, if any, impact on paleontological resources (see section 4.3.2.2 in Volume 2).

4.6.2.3 Effectiveness of Stipulations and Best Management Practice

Under Alternative C, the primary safeguard for paleontological resources is Best Management Practice E-13, which states that lessees will conduct a paleontological resources survey prior to engaging in any potential ground-disturbing activity.

4.6.2.4 Conclusion

Under Alternative C, the primary potential impact to paleontological resources would result from the excavation of gravel for construction of the permanent facilities. However, surveys for paleontological resources are required to be conducted before excavation or any potential ground-disturbing activities could take place. Considering the variability of distribution, density, and context of paleontological resources in the NPR-A and the overall effectiveness of the protection, non-oil and gas and oil and gas activity have a very low probability of adversely impacting paleontological resources. The potential effect of climate change is the same as described for Alternative A.

4.6.3 Soil Resources

4.6.3.1 Activities Not Associated with Oil and Gas Exploration and Development

Various types of activities not related to oil and gas leasing and development, including private or commercial air traffic, use of off-highway vehicles, recreational camps, paleontological and archaeological excavations, and overland moves could affect soil resources in the planning area under Alternative C.

Under Alternative C, impacts associated with non-oil and gas activities would be similar to those described under Alternative A for all alternatives. These activities could occur throughout the planning area and would be little affected by the increased availability of land for oil and gas leasing.

4.6.3.2 Oil and Gas Exploration and Development Activities

The following analysis is based on section 4.2.1.2 in Volume 2, “Oil and Gas Exploration and Development Activities.” See that section for a discussion of estimates and assumptions for development as well as a description of how estimated areas of disturbance were calculated for each alternative.

During oil and gas exploration and development, various activities could cause impacts to soil resources in the planning area. These activities include seismic activities; construction and use of gravel pads, gravel roads, gravel airstrips, and pipelines; excavation of material sites; construction of ice roads and ice pads; and summer tundra travel. Impacts could also occur from oil spills and from removal of gravel pads and gravel roads during rehabilitation. These activities would impact soil productivity and could alter the moisture regime of tundra near the structure by changing natural drainage patterns and areas where snow accumulates. Types of impacts to soils from oil and gas activities in Alternative C would be similar to those described for Alternatives A, B-1, and B-2. Differences in the magnitude and area of impacts for Alternative C are described below.

Effects of Disturbances

Seismic Surveys

The types of effects to soils from seismic surveys would be the same as for Alternative A. Under Alternative C, it is assumed there would be three more seismic surveys (one additional 2-D and two additional 3-D) than for Alternatives A, B-1, and B-2. Short-term soil disturbance from 2-D and 3-D seismic surveys combined would total a maximum of 669,839 acres and for seismic camp moves would total 49,055 acres. The overall total for surveys and camp moves would be 718,894 acres (3.2 percent of the 22.8 million-acre NPR-A). Long-term disturbance (greater than 8 to 9 years) is estimated to total 2,453 acres.

Exploration

It is anticipated that under Alternative C there would be a greater number of exploration and delineation wells drilled than under Alternatives A, B-1, and B-2. This could result in similar types but a greater number of exploration and delineation wells drilled than under Alternatives A, B-1, or B-2, which would increase the impacts of well collar construction and the number and impacts of both ice pads and ice roads. During the life of the plan, it is assumed that 122 exploration wells and 122 delineation wells for oil or gas, or a total of 244 wells, would be drilled from ice pads in the NPR-A under Alternative C. At 6 acres per pad, these would impact 1,464 acres of tundra, spread out over 30 years (24 percent more than Alternative A, 91 percent more than Alternative B-1 and 60 percent more than Alternative B-2). However, some of these wells could be located on Teshekpuk Lake, reducing the total area of direct soil surface disturbance.

Under Alternative C, ice road and snow trail construction would also increase in terms of total miles because of the increase in number of exploration wells and permanent facilities constructed. The total short-term disturbance from ice roads over 30 years would be 431,294acres, about 33 percent more than for Alternative A, 86 percent more than for Alternative B-1, and 73 percent more than for Alternative B-2. Since soil recovery from ice road impacts is expected within a few years (Yokel et al. 2007), long-term disturbance from ice roads and snow trails should be negligible. Although some evidence of crushed tussocks and minor areas of subsidence may still be apparent, new growth would preclude any exposed soils.

Ice airstrips are also used during exploratory drilling, and under Alternative C, it is assumed that 125 ice airstrips would be constructed over 30 years, covering 11 acres each for a total of 1,375 acres (25 percent more than Alternative A and 92 percent more than Alternatives B-1 and B-2). These airstrips are commonly built on the grounded ice of large lakes, but if they were built over tundra they would result in impacts similar to ice roads.

The construction of well cellars during exploration requires the digging of a hole that destroys soil on approximately 64 square feet (0. 0015 acre) of ground. Thermokarst associated with the disruption of thermal regime in the surrounding soil may also change the soil properties around the well cellar to a wetter regime. These impacts could result in 0.4 acre of soil being destroyed under Alternative C (24 percent more than Alternative A, 91 percent more than for Alternative B-1, and 61 percent more than Alternative B-2).

Development and Production

During oil and gas development and production, various activities could cause impacts to soils in the NPR-A. These activities include construction and use of gravel pads, staging areas, roads, airstrips, pump stations, compressor stations and pipelines, excavation of material sites, and construction of ice roads and ice pads. Ice roads and pads are covered above.

Placement of Gravel Fill

Types of impacts to soils from placement of gravel fill would be similar to those in Alternative A. Construction of central processing facilities or central gas facilities and associated satellite pads, staging areas, roads, and airstrips would result in the loss of soil productivity in the areas of gravel placement. Under this alternative, 12 central processing facilities and 39 central gas facilities, and associated satellite pads, roads and airstrips, two pump stations, one compressor station and six staging bases would be developed, resulting in 9,650 acres of soil buried by gravel placement (36 percent more than under Alternative A, 92 percent more than under Alternative B-1, and 72 percent more than under Alternative B-2).

Construction of gravel pads, roads, staging areas, and airstrips could alter the moisture regime of tundra near the structure by changing natural drainage patterns and areas where snow accumulates. Snowdrifts caused by gravel structures would increase the wintertime soil surface temperature and increase thaw depth in soils near the structures. These impacts would be exacerbated by dust deposition and by the formation of impoundments. These factors could combine to warm the soil, deepen thaw, and cause thermokarst adjacent to roads and other gravel structures (National Research Council 2003). In flat, thaw-lake plains on the North Slope, gravel construction can be anticipated to result in upslope water impoundment and thermokarst erosion equivalent to the area directly covered by gravel (Walker et al. 1987). In general, most changes in the plant community around gravel structures would occur within 164 feet of the structure. If all effects were to occur within this zone, a maximum of 40,493 acres would be impacted under Alternative C (38 percent more than under Alternative A, 95 percent more than under Alternative B-1, and 72 percent more than under Alternative B-2). Note that this area includes the 37,036 acres affected by dust below, and is not in addition to it.

The increased construction and use of facilities under Alternative C would result in a larger area impacted by dust than under the other alternatives. Assuming a total of 971 miles of in-field gravel roads and 50 airstrips (47.3 miles), there is a potential for a total perimeter of 2,037 miles. Within 30 feet of gravel fill, up to 7,407acres of soil could be subject to loess deposits of dust and gravel, and another 29,629 acres could be affected by a dust shadow.

Material Sites

In this analysis, the likelihood of new gravel sites within the planning area would be somewhat greater under Alternative C than under Alternatives A, B-1, and B-2. Gravel required for development in the planning area could be mined from existing sites east of the NPR-A or could be extracted from new sites developed within the planning area. Investigations to identify gravel sources in the planning area have not been conducted, but presumably would be initiated if discoveries of recoverable oil or gas were made. Under Alternative C it is assumed that up to 52 material sites would be needed. This would cover a total area of 1,941 acres (37 percent more than under Alternative A, 93 percent more than under Alternative B-1, and 73 percent more than under Alternative B-2). Excavation of gravel and stockpiling of overburden would destroy soils at these sites.

Pipelines

Under Alternative C, given the potentially greater number of fields developed, impacts from pipeline construction would be greater than those described for Alternatives A, B-1 or B-2. Pipelines on the North Slope are typically built on vertical support members with a disturbance of about 15 square feet each and a spacing of about 150 vertical support members per mile. About 6 percent of the soil in this area would be destroyed and replaced by the vertical support member, and the remaining portion would be potentially altered in terms of soil profile with a shift toward parent materials. Approximately 0.05 acre of soil would be disturbed per pipeline mile for oil-gathering pipelines, and 0.03 acre per mile of regional oil pipelines. Under Alternative C, 224 miles of gathering lines for oil, and 594 miles of regional oil pipelines would disturb about 29 acres of soil through vertical support member placement, or the same as under Alternative A. Ice roads built for construction of these pipelines would have short-term impacts to soils on less than 3,468 acres. In reality, some of the vertical support members for gathering lines would be over gravel pads and would have no additional impacts on soils, nor would ice roads be necessary for constructing these portions of pipeline.

Under Alternative C, the types of impacts on soils that natural gas development and production would cause would be the same as those described for Alternatives A, B-1, and B-2, but the extent of such impacts may be larger. If a gas pipeline is buried, there would be additional acreage of soils disrupted with reduced soil productivity. The estimated 1,981 miles of gas pipeline would impact about 3,602 acres of soils directly through excavation of a 4-foot-wide trench and, potentially, a total of 12,006 acres through compaction, thermokarst, and other indirect effects. In addition, ice roads that may be associated with placement of the gas pipeline would have localized, short-term impacts on soils, which would usually be limited to compression of the tundra under the ice roads and damage to the tops of tussocks in dryer soils.

Soils thus disturbed in the ice-rich northern part of the planning area are more likely to experience thermal degradation and subsidence as a result. In this case, the soils would not be lost completely, but soil horizons as well as the thermal regime would be altered. Melting of ice in the soils would result and the filled area, normally mounded immediately after fill, would level over time as melt water migrates. Ponding, and potentially soil erosion, could occur if the trench surface subsides below the grade of the surrounding terrain over time. These impacts would be dramatically reduced if gas pipelines were put on vertical support members.

Summer Tundra Travel

Under Alternative C, some summer tundra travel would be permitted under specific circumstances. Although travel off of gravel pads is easiest in winter and generally environmentally preferable at that time, some vehicle travel off of pads does occur in North Slope oil fields during the summer to accomplish specific tasks. The State of Alaska has approved some low-ground-pressure vehicles for summer tundra travel after July 15. Similar summer tundra travel may be anticipated to be part of oil production in the NPR-A.

Summer vehicle tundra travel is commonly associated with spill prevention and preparedness measures required in spill prevention plans. Each summer season, low-ground-pressure vehicles might be used to transport and place booms across streams downstream from pipelines. These booms are left in place through the summer to capture any oil that might spill from a pipeline and then would be retrieved, again probably using low-ground-pressure vehicles, before freeze-up. Pipeline inspections may also entail summer vehicle travel on the tundra. Finally, periodically spill response training may occur along and downstream from pipelines in summer.

As a rule, summer tundra travel would not be permitted under Alternative A. Therefore, given the potentially greater number of fields developed and allowance of summer tundra travel under certain circumstances, impacts from summer tundra travel under Alternative C could be greater than in the other alternatives. Long-term, minor impacts to soils are expected from limited summer tundra travel using low-ground-pressure vehicles. However, Required Operating Procedure L-1 is designed to regulate and monitor summer travel and minimize impacts to soils and vegetation. Summer travel would only be permitted on a case-by-case basis if the applicant can demonstrate that the proposed use would have no more than minimal impacts to soils and the protective vegetative cover.

Effects of Oil and Gas Development on Permafrost

Types of impacts to permafrost from oil and gas development would be the same as those described in Alternative A. Under Alternative C, more surface disturbance is expected from oil and gas activities as compared to the other alternatives (Table 4-14 in Volume 2). Therefore, there would be more area of permafrost potentially affected.

Effects of Abandonment and Reclamation

Types of impacts from abandonment and reclamation would be the same as those described in Alternative A. Under Alternative C, it is expected that more structures would be constructed for oil and gas activities as compared to the other alternatives. Therefore, the amount of reclamation required, and impacts to soils from abandonment and reclamation, would be greater than under the other alternatives. During abandonment activities, soils would be impacted by dust deposition along roads, by ice roads and other off-road tundra travel associated with dismantling of pipelines and powerlines, and by disturbance to soils adjacent to vertical support members and power line poles during their removal. The level of impact from these activities would be roughly the same as that during construction if gravel fill was removed; impacts would be less if the gravel were left in place. If roads and pads were left in place, and especially if cross drainage across roads was not maintained, water impoundment would occur, and could alter soil hydrology as described for the construction period. It is also likely that the unmaintained roads would have occasional washouts, where soils would be covered with washed-out gravel (alluvium). Roads and pads, if left in place, would likely have soils similar to native to gravel bars and ridges in the Arctic (i.e., different from the native soils surrounding the facilities). Development of soil profiles could take several years, as the harsh climate is not conducive to rapid changes in soil. Removal of gravel from pads, roads, and airstrips could be mandated. Partial or complete removal of gravel can result in additional thaw subsidence, which is difficult to predict, and complete restoration to preexisting conditions is improbable.

Effects of Spills and Gas Releases

Alternative C has a greater amount of leasing, development, and production of oil (compared to Alternatives B-1 and B-2 and it is the same as Alternative A). Alternative C has a greater amount of leasing, development, and production of gas (compared to Alternatives A, B-1, and B-2). This would result in a greater number of small spills of crude and refined oil, produced water and seawater in the NPR-A (compared to Alternatives B-1 and B-2, but the same as Alternative A), but a larger number of gas releases due to the increased miles of regional gas pipelines assumed. The probability of a large oil spill occurring would also be greater under Alternative C than under Alternatives B-1 and B-2, and the same as Alternative A; but for analysis the assumption remains at one large spill.

Most oil spills cover less than 500 square feet (less than 0.01 acre), although a pressured aerial mist may cover up to 145 acres (Ott 1997). (Such a spill is a very low probability event, occurring less than once out of the total spills expected throughout the life of this plan. Thus, its magnitude is not apparent in the following acreages.) If 11 percent of all oil spills would reach the soil during summer, under Alternative C this would mean 57 of the 515 crude and refined oil spills assumed to occur over the life of the plan would have more than a negligible effect on soils. Assuming the average spill would cover 0.1 acre, under Alternative C, approximately 6 acres would be impacted substantially during the lifetime of development in the NPR-A. This is the same as the acreage impacted under Alternative A, 91 percent more for Alternative B-1, and 61 percent more than under Alternative B-2. Overall, past spills on Alaska's North Slope have resulted in minor ecological damage and ecosystems have shown good potential for recovery (Jorgenson 1997).

A single gas release occurring with ignition could have thermal effects to approximately 194 acres of tundra soils (500-meter radius). The assumed number of gas releases under Alternative C (5.9 = 1,981 miles of pipe at a rate of 0.9 incidents per 300 pipe miles), if ignited, would result in thermal effects to approximately 1,153 acres of tundra soil. If a wildfire resulted, additional acreage would burn, the amount depending on season, weather conditions, moisture content of vegetation and soil organic layers, and suppression effort. Most North Slope tundra fires are less than 1,000 acres (Racine and Jandt 2008). Total vascular plant cover is a good measure of soil conditions and following lightning-caused tundra fires, it has reached 50–100 percent after 5 to 6 years (Racine et al. 1987). Severely burned areas may not be capable of supporting vascular plants until they have gone through early development, which starts with lichens. Lichens, however, could take several decades to recover if they can achieve former densities at all under a climate-warming regime (Jandt et al. 2008).

Effectiveness of Stipulations and Required Operating Procedures

Under Alternative C, the lease stipulations and required operating procedures that protect soil resources would be the same as those discussed for Alternatives B-1 and B-2 with the exception of stipulation K-11 which is not applicable to Alternatives B-1 or B-2 because it would allow no leasing in the area affected by the stipulation. Many of the lease stipulations and required operating procedures, as discussed under Alternatives B-1 and/or B-2, would directly or indirectly limit potential impacts to soils in the planning area. Under Alternative C, development in the NPR-A would result in greater impacts to soil and plant communities compared to Alternatives A, B-1, and B-2, due to the greater extent of gravel fill, material sites and buried gas pipelines. The best management practices and lease stipulations associated with Alternative C would reduce impacts by ensuring the minimum necessary exposure of soils and alteration of plant communities.

4.6.3.3 Conclusion

Under Alternative C, the amount of soil area impacted from oil and gas exploration and development would potentially exceed those of Alternatives A, B-1, and B-2, as additional oil and gas areas would be available for leasing. Numerous technological advancements have been made during the decades of operations on the North Slope that have allowed current development activities to proceed with less environmental impact than previous operations (National Research Council 2003). However, some short-term disturbance and permanent long-term impacts to soils are inevitable. Loss of permafrost and soil insulation from activities associated with this alternative could be exacerbated by climate change as described in the conclusion of Alternative A.

Impacts to soil from management actions under Alternative C would involve short-term disturbance over fairly large areas and long-term disturbance of relatively small areas. However, even though impacts in Alternative C cover more of the planning area than the other alternatives (Table 4-14 in Volume 2), all areas of soil disturbance would be relatively small as a percentage of the entire planning area (see below). The duration of these impacts could range from one year or less for minor disturbance of soil and vegetation to decades if the soil was destroyed or permafrost thawing was extensive.

Under Alternative C, impacts to soils from activities other than oil and gas development would be similar to those of the other alternatives and would include minor impacts from activities such as aircraft landings, archaeological or paleontological excavations, camps, and overland moves. Recovery would vary from one year for minor disturbance of soil and vegetation to one or more decades in those areas where soil was excavated or permafrost thawing was extensive.

As for other alternatives, impacts to soils from oil and gas exploration under Alternative C would occur from seismic work and construction of well cellars during exploratory drilling and the construction of ice roads and ice pads. The duration and recovery time for impacts associated with seismic work would be similar to those for overland moves and the same as for Alternatives A and B-2. Based on earlier studies, there should be no substantial, long-term impacts to soils from seismic lines, but substantial impacts from camp move trails could remain on approximately 2,453 acres after 8 to 9 years. Effects of well cellar construction would also be permanent, but would impact only 0.4 acre of soil.

Under Alternative C, the effects of oil and gas development and operation would include destruction of soil structure during construction of gravel pads (central processing facilities and central gas facilities, satellite drill pads, pump and compressor stations, and staging bases), roads and airstrips; from excavation of material sites and burial of gas pipelines; and construction of vertical support members. These impacts would be long-term and would impact about 15,311 acres, or 0.07 percent of the 22.8 million-acre NPR-A (as compared to 0.04 percent under Alternative A, 0.03 percent more for Alternative B-1, or 0.04 percent under Alternative B-2). Soil profiles could also be altered by dust deposition, salinity of gravel fill used in construction, snowdrifts, and blockage of or change to natural drainage patterns. These impacts would also be long-term and would impact about 40,592acres, or 0.2 percent of the NPR-A (38 percent more than the amount of soil impacted under Alternative A, 96 percent more for Alternative B-1, or 72 percent more than under Alternative B-2).

It is assumed that impacts to soils would occur in proportion to their occurrence within the NPR-A. However, precluding development in a large block in the south of the NPR-A would disproportionately conserve gravel resources and their vegetative communities.

Areal extent of short-term impacts under Alternative C would be about 34 percent more than for Alternative A, 87 percent more for Alternative B-1, and 74 percent more for Alternative B-2. Areal extent of long-term impacts under Alternative C would be about 55 percent more than for Alternative A, 104 percent more for Alternative B-1, and 82 percent more for Alternative B-2. Impacts to soils from non-oil and gas activities, and from oil and gas activities, would likely be additive, except in those areas where the two types of activities overlapped. Impacts to soils from exploration and development activities would also be additive, except where development activities occurred in areas previously disturbed during exploration. In areas where two or more activities occurred, overall impacts would reflect those impacts associated with the first activity and any new impacts associated with later activities.

Impacts associated with oil spills, the majority of which would be cleaned up immediately, could adversely affect soil resources for a few years to several decades depending on the quantity, location, and season of the spill. The potential for impacts from oil spills would be greater under Alternative C than under the other alternatives since more area would be available for development in an area with relatively high oil and gas potential, and the estimated number of large and small spills is slightly greater than in the other alternatives (see section 4.2.2.1, “Oil Spills” in Volume 2).

Under Alternative C, some summer tundra travel would be permitted under specific circumstances. Short-term, minor impacts are expected from limited summer tundra travel using low-ground-pressure vehicles. However, Required Operating Procedure L-1 is designed to regulate and monitor summer travel and minimize impacts to soils and vegetation. Summer travel would only be permitted on a case-by-case basis if the applicant can demonstrate that the proposed use would have no more than minimal impacts to soils and the vegetative cover that protects it.

Although all soil map units identified on Map 3.2.8-1 could be impacted during oil and gas exploration and development, soil associated with map units S9277 and S9320 (see section 3.2.7 in Volume 1, “Soil Resources” and Map 3.2.8-1) would likely be most affected since they are located in the area having high oil potential. Lease stipulations and required operating procedures developed for Alternatives B-1, B-2 and C would provide protection similar to or slightly greater than lease stipulations in Alternative A.

4.6.4 Surface and Groundwater Resources and Water Quality

Alternative C makes more than 17.9 million acres (76 percent of federal subsurface lands in the NPR-A) immediately available for leasing. Selected coastal areas would not be available for oil and gas leasing. In addition, about 4.4 million acres in the far south of the Reserve would be unavailable for leasing. The alternative would provide surface protections from oil and gas development elsewhere in the Reserve, most notably near Teshekpuk Lake. The alternative would provide areas for corridors to bring oil and gas from potential future offshore development in the Chukchi and Beaufort seas to market and would not make currently deferred lands available until after the expiration of the deferrals described in

Alternative A. Section. 2.3.3 describes this alternative in greater detail. Based on the potential for leasing, Alternative C would have the second highest potential for impacts to water resources and quality from exploration and development.

4.6.4.1 Activities Not Associated With Oil and Gas Exploration and Development

Under Alternative C, impacts to water resources and quality associated with non-oil and gas activities would essentially be the same as those described under Alternative A, section 4.3.4.1 in Volume 2.

4.6.4.2 Activities Associated With Oil and Gas Exploration and Development

Effects of Seismic Surveys

Modern-day seismic equipment has caused minimal impact to the tundra, but camp move vehicles can still cause thermokarst, especially when snow is insufficient to protect soil and vegetation (WesternGeco 2003). Removal or damage of the organic mat exposes soils to erosion by wind and water, which could deposit sediment into waterbodies resulting in higher turbidity and concentrations of suspended sediment. To cause high turbidity, the peat mat must be sufficiently eroded to expose underlying mineral soils, and the mineral soils must be fine grained. Best Management Practice C-2 requires ground operations to commence only when frost and snow are at sufficient depths to protect stream banks, and minimize the breakage, abrasion, compaction, or displacement of vegetation and prevent future thermokarst.

Studies of impacts to vegetation from seismic activity are discussed in section 4.3.5.2 in Volume 2. It is estimated that a total of 2,452 acres of moderate to high impacts from seismic activities could result from Alternative C, more than Alternatives A, B-1, and B-2, and less than Alternative D. These long-term impacts may result in thermokarst erosion with increased turbidity in local waterbodies.

Effects of Water Withdrawal from Lakes

The primary source of water during the winter months is unfrozen water that lies beneath the ice cover of both shallow and deep lakes. This water is somewhat saline because of the exclusion of ions during the freezing of the upper part of the lake. Water from lakes may be used for ice roads, pads and airstrips, and for drilling and production water and potable water at drilling facilities, but the volume of water taken from an individual lake depends on the depth of the lake, depth of unfrozen water in the lake and the presence of fish and the type of fish present.

Best Management Practice B-2 insures water permitting requirements are followed and are supplemented by water monitoring plans as needed to insure lakes are replenished. Effects during exploration on water quality from water withdrawals would be short term and minor, returning to normal levels after breakup. Alternative C, with the second highest number of wells to be drilled is expected to require greater amounts of water than Alternatives A, B-1, and B-2 and less than Alternative D. The provisions under Alternative C are adequate to insure water quality and quantity is maintained after water withdrawals.

Effects of Ice Roads, Ice Pads and Ice Bridges

Ice roads and ice pads are used extensively during the winter exploration season for access and for exploration drilling and testing. Best Management Practice C-3 requires river crossings to be made at low angles if at all possible, and remove, breach, or slot ice bridges before breakup. Ice roads may be required to be breached at stream crossings, especially if fish passage is a concern or the quantity of expected flow is significant during breakup. Under all of the alternatives, no long-term impacts are anticipated from ice roads, ice pads or ice bridges.

Effects of Exploratory Drilling

Drilling operations require large amounts of water to create drilling fluid, which must be disposed of at the completion of drilling operations. Drilling fluid is typically a preparation of water, clay, and chemicals that are circulated into a well during drilling and must be disposed of when operations cease. Best Management Practice A-2 requires all cuttings and drilling mud to be disposed of by injection, allowing on-pad temporary storage of muds and cuttings, as approved by Alaska Department of Environmental Conservation. Freshwater aquifers are protected by surface casing, which is installed and cemented in place at varying depths, which are determined by State natural gas and oil regulatory agencies. Lease Stipulation D-1 prohibits exploratory drilling in rivers and streams, as determined by the active floodplain and fish-bearing lakes unless there is no feasible or prudent alternative. These protective measures would decrease the risk of drilling muds or oil from blowouts from entering adjacent waterbodies.

Under Alternative C up to 236 oil and gas exploration and delineation wells may be drilled. Under Alternatives A, B-1, B-2 and D, 196, 128, 152, and 256 wells, respectively, may be drilled. The number of rigs estimated under Alternative C indicates that there should be greater impacts from exploratory drilling than Alternatives A, B-1, and B-2 and less than Alternative D. Exploratory drilling under Alternative C is not expected to have a measurable effect on water quality since spills would occur in the winter and would likely occur on ice pads.

Effects of Drainage Disruption by Gravel Roads, Pads, Runways and Pipelines

Drainage disruptions by gravel roads, pads, runways, and pipelines and associated impacts from impoundments, thermokarst, erosion, sedimentation and turbidity are discussed in section 4.3.4.2 in Volume 2. Best management practices and lease stipulations designed to reduce or eliminate these impacts are described in section 4.4.4.3 in Volume 2.

Because more or less infrastructure is estimated to occur in different alternatives, the potential for some shortcoming in design of infrastructure to result in impacts will vary with that variation among the alternatives. The stipulations and design requirements described above should provide adequate protection to ensure natural flow characteristics and water quality is maintained.

Under Alternative C, the BLM estimates 9,387 acres of gravel placement for production pads, in-field roads and runways. This compares to Alternatives A, B-1, B-2 and D with 7,074, 5,037, 5,614, and 10,439 acres, respectively. Alternative C would have less disruption of drainages, erosion and sedimentation than Alternative D, but more than Alternatives A, B-1 and B-2. If lease stipulations and BMPs listed for this alternative are followed, impacts should be minor.

Effects of Gravel Pits

Removal of gravel from areas near streams and lakes can result in changes to stream or lake configurations, stream-flow hydraulics, lake shoreline flow patterns, erosion, sedimentation, and ice damming (National Research Council 2003). Locating gravel pits at an adequate distance from streams and lakes would minimize these impacts. Gravel mining in the coastal plain would create some localized sedimentation and new or enlarged waterbodies, particularly if gravel was extracted from within floodplains. Gravel extraction outside the floodplain, especially within the foothills, would be less likely to create new lakes, but could produce sedimentation. BMP E-8 would locate gravel mine sites outside active floodplains whenever possible.

Alternative C projects up to 51 gravel pits (1,868 acres), could be required for the development scenarios presented in Table 4-14 in Volume 2. This compares to 40 (1,415 acres), 29 (1,007 acres), 31 (1,125 acres) and 55 (2,088 acres) gravel pits, respectively, for Alternatives A, B-1, B-2, and D.

Effects from Waterflooding

Waterflooding is a process of injecting water into underground reservoir rock to maintain reservoir pressure and maximize recoverable oil reserves. Alaska Oil and Gas Conservation Commission oversees the Underground Injection Control Program to ensure underground sources of drinking water are protected. Under Alternative C, an estimated 738 oil production and service wells and 423 gas production and water disposal wells could be drilled, resulting in potentially greater impacts than Alternatives A, B-1, and B-2. Impacts to groundwater resources or from spills transporting seawater to wells for waterflooding are expected to be minimal.

Effects of Oil Spills and Gas Releases

Under Alternative C, the types of impacts to water resources and quality associated with oil spills and gas releases would essentially be the same as those described under Alternative A, section 4.3.4.2 in Volume 2. Section 4.4.4.3 in Volume 2 discusses stipulations and BMPs that would help reduce the risk of fuel-related spills.

Under Alternative C the BLM estimates there could be 514 small spills of refined and crude oil less than 500 barrels in size. This compares to estimates of 525, 367, 399, and 553 spills, respectively, from Alternatives A, B-1, B-2, and D. Alternative C predicts a 37 percent chance of one or more large oil spills greater than 500 barrels and a 54 percent chance of one or more large spills greater than 500 barrels of produced water or seawater, which are the greatest potential for spills than all other alternatives.

Effects of Abandonment and Reclamation

Removal of facilities, particularly roads, bridges, and culverts, would likely cause increased sedimentation and erosion immediately after removal. However, natural drainage will be reestablished within several years to more than a decade depending upon the facilities removed and the local hydrology and terrain. Leaving pads, airstrips, roads, bridges, and culverts in place, particularly without future maintenance, however, would result in longer-term, higher levels of erosion, sedimentation, and upslope impoundment. Ponds would be formed from melting of ice wedges or other ice underlying the gravel facilities. Leaving the roads in place, but removing bridges and culverts and breaching the roads where culverts had been placed, would reduce upslope impoundment.

Because under Alternative C more gravel infrastructure would be created than in Alternatives A, B-1, and B-2, more sedimentation, erosion, and water impoundment could result than in those alternatives. Only Alternative D, with somewhat more projected infrastructure, would likely result in more impacts.

4.6.4.3 Effectiveness of Lease Stipulations and Best Management Practices

The lease stipulations and BMPS protective of water resources and water quality have been discussed in the above sections of Alternative C. A complete listing of these stipulations and BMPs are also listed in Alternative B-1, section 4.4.4.3 in Volume 2.

4.6.4.4 Conclusion

The potential impacts to water resources and quality from oil exploration and development activities under Alternative C include the following: turbidity changes of waterbodies due to thermokarst from seismic and overland travel activities and from dust effects adjacent to roads and pads; losses of water and possible water quality changes from water withdrawals; erosion and sedimentation associated with road and pad building; inadequately designed river crossing structures; impounded water at road crossings; alteration of drainages from pipelines, pads, ice and gravel roadways, airstrips, and gravel mines; and impacts on water quality from oil, produced water and seawater spills into waterbodies.

Global climate change could have unpredictable impacts on winter temperatures, water balance and availability of water, timing and magnitude of spring floods, rising sea level, storm surges, and coastal erosion. A shortened winter season and warmer soil temperatures could increase the potential to damage vegetation from seismic surveys and overland travel and result in thermokarst. A longer growing season could result in increased potential evapotranspiration reducing available water in lakes. Premature melting of ice roads could occur with sudden spring melts, requiring emergency demobilization of drilling operations in order to protect the tundra. Increased snowfall combined with late summer rainfall could increase the magnitude of spring peak flows above the normal range of flows. Greater expanses of open water on the Beaufort and Chukchi seas could increase the potential for storm surges to cause accelerating rates of coastal erosion and flooding of inland lakes and ponds. All alternatives under consideration would be affected, although fewer impacts under Alternative B-1 and B-2 would occur due to less development in the Teshekpuk Lake area.

Adherence to federal and State operational guidelines, best management and safety practices, planning requirements, lease stipulations and BMPs will all serve to reduce impacts from these activities. Some localized, but temporary effects to water resources or quality may occur from most activities described in Alternative C. The exception would be the case for permanent gravel pads and stream crossing structures and very large spills, which would have long-term impacts described in the above sections.

In general, impacts between alternatives are proportional to acres available to leasing and projected future production. Alternative C would be expected to have more impacts to water resources and quality than Alternatives A, B-1, and B-2, but less than Alternative D.

4.6.5 Vegetation

4.6.5.1 Activities Not Associated with Oil and Gas Exploration and Development

Under Alternative C, impacts to vegetation associated with non-oil and gas activities would essentially be the same as those described under Alternative A.

4.6.5.2 Oil and Gas Exploration and Development Activities

Exploration

Under Alternative C, types of impacts to vegetation from activities associated with oil and gas exploration would be similar to those that occur under other alternatives. There would be a greater number of exploration and delineation wells drilled than under Alternatives A, B-1, or B-2, which would increase the impacts of well collar construction and the number and impacts of both ice pads and ice roads.

Under Alternative C, it is assumed there would be three more seismic surveys (one additional 2-D and two additional 3-D) than for Alternatives A and B-1. Short-term vegetation disturbance from 2-D and 3-D seismic surveys combined would total a maximum of 669,839 acres and for seismic camp moves would total 49,055 acres (Table 4-11 in Volume 2). The overall total for surveys and camp moves would be 718,894 acres (3.2 percent of the 22.8-million-acre NPR-A). Long-term disturbance (greater than 8 to 9 years) is estimated to total 2,453 acres.

During the life of the plan, it is assumed that 122 exploration wells and 122 delineation wells for oil or gas, or a total of 244 wells, would be drilled from ice pads in the NPR-A under Alternative C. At 6 acres per pad, these would impact 1,464 acres of tundra, spread out over 30 years (24 percent more than Alternative A, 90 percent more than Alternative B-1, and 61 percent more than Alternative B-2).

Under Alternative C, ice road and snow trail construction would also increase in terms of total miles because of the increase in number of exploration wells and permanent facilities constructed. The total short-term disturbance from ice roads over 30 years would be 422,810 acres, about 30 percent more than for Alternative A, 82 percent more than for Alternative B-1, and 70 percent more than for Alternative B-2. Since vegetation recovery from ice road impacts is expected within a few years (Yokel et al. 2007), long-term disturbance from ice roads and snow trails would be negligible. Although some evidence of crushed tussocks may still be apparent, new growth would preclude any exposed soils.

Ice airstrips are also used during exploratory drilling, and under Alternative C, it is assumed that 125 ice airstrips would be constructed over 30 years, covering 11 acres each, for a total of 1,375 acres (25 percent more than Alternative A and 92 percent more than

Alternative B-1 or B-2). These airstrips are commonly built on the grounded ice of large lakes, but if they were built over tundra, they would result in impacts similar to ice roads.

The construction of well cellars during exploration requires digging a hole that destroys vegetation on approximately 64 square feet (0. 0015 acre) of ground. Thermokarst associated with the disruption of thermal regime in the surrounding soil may also change the vegetation type around the well cellar to a wetter vegetation type. These impacts could result in 0.4 acre of vegetation being destroyed under Alternative C (20 percent more than Alternative A, 84 percent more than Alternative B-1 and 61 percent more than Alternative B-2).

Development

During oil and gas development and production, various activities could cause impacts to vegetation in the NPR-A. These activities include construction and use of gravel pads, staging areas, roads, airstrips, pump stations, compressor stations and pipelines, excavation of material sites, and construction of ice roads and ice pads. Ice roads and pads are covered above.

Placement of Gravel Fill

Construction of central processing facilities or gas compressor facilities and associated satellite pads, roads, staging areas, pump or compressor stations and airstrips would result in the destruction of vegetation in the areas of gravel placement. Under this alternative, 12 central processing facilities and 39 gas compressor facilities, and associated satellite pads, roads and airstrips, two pump stations, one compressor station and six staging bases would be developed, resulting in 9,650 acres of vegetation destroyed by gravel placement (28 percent more than under Alternative A, 98 percent more than under Alternative B-1, and 81 percent more than under Alternative B-2).

The increased construction and use of facilities under Alternative C would result in a larger area being impacted by dust than under the other alternatives. Assuming a total of 971miles of in-field gravel roads and 47.3 miles of airstrips, there is a potential for a total perimeter of 2,037 miles. Within 30 feet of gravel fill, up to 7,407acres of vegetation could be subject to smothering by dust and gravel, and another 29,628 acres could be affected by a dust shadow.

If all effects were to occur within this zone, a maximum of 40,493 acres would be impacted under Alternative C (38 percent more than under Alternative A, 95 percent more than under Alternative B-1, and 72 percent more than under Alternative B-2). Note that this area includes the 37,035 acres affected by dust above, and is not in addition to it.

The construction of gravel roads into and within the NPR-A would provide a mechanism for the spread of non-native, invasive plants into the NPR-A. The effects of dust and gravel spray from the roads may also provide a substrate suitable for colonization of non-native, invasive plants. Oil and gas development in the NPR-A may cause, or accelerate, the invasion of the NPR-A by non-native, invasive plants. The potential for colonization by non-native, invasive plants could be reduced by pressure washing all equipment and vehicles before moving them into the NPR-A. This could effectively remove any seeds that wedge in cracks or crevices, or adhere to equipment or vehicles. Removing dirt from vehicles could also act to prevent potentially dangerous soil-borne pathogens or contaminants from being introduced to the NPR-A.

Material Sites

Gravel required for development in the NPR-A could be mined from existing sites east of the NPR-A, or could be extracted from new sites developed within the NPR-A. Investigations to identify gravel sources in the NPR-A have not been conducted except for existing discoveries, but presumably would be initiated if additional discoveries of recoverable oil or gas were made. Under Alternative C, it is assumed that up to 52 material sites would be needed. This would cover a total area of 1,941 acres (37 percent more than under Alternative A, 93 percent more than under Alternative B-1, and 73 percent more than under Alternative B-2). Excavation of gravel and stockpiling of overburden would destroy vegetation at these sites.

Pipelines

Under Alternative C, types of impacts from oil and gas pipeline construction would be similar in nature to those described for the other alternatives. The total area disturbed by each vertical support member would be about 15 square feet. About 6 percent of this area would be vegetation destroyed and replaced by the vertical support member, and the remaining portion would be potentially altered in terms of community type or species composition. Approximately 0.05 acre of vegetation would be disturbed per pipeline mile for oil-gathering pipelines, and 0.03 acre per mile of regional oil pipelines. Under Alternative C, 224 miles of gathering lines for oil, and 594 miles of regional oil pipelines would disturb about 27 acres of vegetation through vertical support member placement, or the same as under Alternative A. Ice roads built for constructing these pipelines would have short-term impacts to vegetation on less than 3,469 acres. In reality, some of the vertical support members for gathering lines would be over gravel pads and would have no impacts on vegetation, nor would ice roads be necessary for constructing these portions of pipeline. It is assumed that gas pipelines would be buried, so impacts to vegetation would be different than for oil pipelines. In the case of buried gathering, regional, and high-pressure gas pipelines, short-term disturbance from ice roads would affect 8,616 acres. Long-term impacts from trenching and spoils storage would occur on 3,693 acres.

The potential for impacts to vegetation from air pollution would be slightly greater under Alternative C than Alternative A, given the potential for additional gas fields and processing facilities.

Effects of Abandonment and Reclamation

Under Alternative C, impacts to vegetation from abandonment and reclamation activities would be greater than under other alternatives, because there would be a greater extent of gravel fill to rehabilitate. During abandonment activities, vegetation and wetlands would be impacted by dust fallout along roads, by ice roads and other off-road tundra travel associated with dismantling of pipelines and power lines, and by disturbance to vegetation adjacent to vertical support members and power line poles during their removal. The level of impact from these activities would be roughly the same as that during construction if gravel fill was removed; impacts would be less if the gravel were left in place. If roads and pads were left in place, and especially if cross drainage across roads was not maintained, water impoundment would occur, and could alter plant communities as described for the construction period. It is also likely that the unmaintained roads would have occasional washouts, where tundra vegetation would be covered with washed-out gravel. Roads and pads, if left in place, would likely need to be revegetated with plants native to gravel bars and ridges in the Arctic (i.e., different from the plant communities surrounding the facilities). Revegetation activities could take several years, as initial attempts are not always successful. Removal of gravel from pads, roads, and airstrips could be mandated. Partial or complete removal of gravel can result in faster reestablishment of native plant growth, although establishment can take many years (more than a decade). In addition, thaw subsidence is difficult to predict, and complete restoration to preexisting conditions is improbable.

Effects of Spills and Gas Releases

The increased leasing, development, and production of oil (compared to Alternatives B-1 and B-2; it is slightly less than for Alternative A) and gas (compared to Alternatives A, B-1 and B-2) that would occur under Alternative C, would result in a greater number of small spills of crude and refined oil, produced water, and seawater in the NPR-A (compared to Alternatives B-1 and B-2, but slightly less than Alternative A; Table 4-17 in Volume 2). Alternatively, a larger number of gas releases would be expected due to the increased miles of regional gas pipelines assumed. The probability of a large oil spill occurring would also be greater under Alternative C than under Alternative B-1 or B-2, but less than Alternative A; but for analysis, the assumption remains at one large spill.

Most oil spills cover less than 500 square feet (less than 0.01 acre); although a pressured aerial mist may cover up to 145 acres (Ott 1997). (Such a spill is a very low probability event, occurring less than once out of the total spills expected throughout the life of this plan. Thus, its magnitude is not apparent in the following acreages.) If 11 percent of all oil spills would reach vegetation during summer, under Alternative C, this would mean 57 of the 515 crude and refined oil spills assumed to occur over the life of the plan would have more than a negligible effect on vegetation. Assuming the average spill would cover 0.1 acre, under Alternative C, approximately 6 acres would be impacted substantially during the lifetime of development in the NPR-A. This is the same as the acreage impacted under Alternative A and 50 percent more than under Alternatives B-1 and B-2. Overall, past spills on Alaska's North Slope have resulted in minor ecological damage and ecosystems have shown good potential for recovery (Jorgenson 1997). There are techniques that may accelerate the clean-up process after an oil spill (e.g., Yakubu et al. 2009).

A single gas release occurring with ignition could have thermal effects to approximately 194 acres of tundra vegetation (500 m radius). The assumed number of gas releases under Alternative C (6.2 = 0.9 incidents per 300 pipe miles times 2,077 miles of pipe), if ignited, would result in thermal effects to approximately 1,203 acres of tundra. If a wildfire resulted, additional acreage would burn, the amount depending on season, weather conditions, moisture content of vegetation, and suppression effort. Most North Slope tundra fires are less than 1,000 acres (Racine and Jandt 2008). Total vascular plant cover following lightning-caused tundra fires reached 50–100 percent after 5 to 6 years (Racine et al. 1987). Lichens, however, could take several decades to recover, if they can achieve former densities at all under a climate-warming regime (Jandt et al. 2008).

4.6.5.3 Effectiveness of Stipulations and Best Management Practices

Alternative C would have the same lease stipulations and best management practices as those outlined under Alternative B-1, with the exception of Lease Stipulation K-11, which is not applicable to Alternative B-1 because it would allow no leasing in the area affected by the stipulation. Under Alternative C, development in the NPR-A would result in greater impacts to vegetation and plant communities compared to Alternatives A, B-1, and B-2, due to the greater extent of gravel fill, material sites, and buried gas pipelines. The best management practices and lease stipulations associated with Alternative C would reduce impacts by ensuring the minimum necessary destruction of vegetation and alteration of plant communities.

4.6.5.4 Conclusion

Under Alternative C, impacts to vegetation from activities other than oil and gas development would be essentially the same as those under Alternatives A, B-1, and B-2, and would include minor impacts from aircraft landings, archaeological and paleontological excavations, camps, and overland moves. The duration of the causes of these impacts would be short-term, ranging up to five months, and recovery would vary from one to several years. Some impacts from snow machines and ATVs, where the same trail is followed continuously such as near villages, could be major (but localized) and would not recover as long as the traffic continues.

As for other alternatives, impacts to vegetation from oil and gas exploration under Alternative C would occur from seismic work and construction of well cellars during exploratory drilling and the construction of ice roads and ice pads. The duration and recovery time for impacts associated with seismic work would be similar to those for overland moves and the same as for Alternatives A and B-1. Based on earlier studies, there should be no substantial, long-term impacts to vegetation from seismic lines, but substantial impacts from camp move trails could remain on approximately 2,453 acres after 8 to 9 years. Effects of well cellar construction would also be permanent, but would impact only 0.4 acre of vegetation.

Under Alternative C, the effects of oil and gas development and operation would include destruction of vegetation during construction of gravel pads (central processing facilities and gas compressor facilities, satellite drill pads, pump and compressor stations, and staging bases), roads and airstrips; from excavation of material sites and burial of gas pipelines; construction of vertical support members; and the potential for colonization by non-native, invasive species. These impacts would be long-term and would impact about 15,311 acres, or 0.07 percent of the 22.8-million-acre NPR-A (as compared to 0.04 percent under Alternative A or 0.03 percent under Alternative B-1). Plant communities could also be altered by dust deposition, salinity of gravel fill used in construction, snowdrifts, and blockage of or change to natural drainage patterns. These impacts would also be long-term and would impact about 40,493 acres, or 0.2 percent of the NPR-A (33 percent more than the amount of vegetation impacted under Alternative A, or 88 percent more than under Alternative B-1).

It is assumed that impacts to vegetation types or communities would occur in proportion to their occurrence within the NPR-A. However, precluding development in a large block in the south NPR-A would disproportionately conserve dwarf shrub, tussock tundra, and sparsely vegetated communities.

Areal extent of short-term impacts under Alternative C would be about 34 percent more than for Alternative A. Areal extent of long-term impacts under Alternative C would be about 55 percent more than for Alternative A. Impacts to vegetation from non-oil and gas activities, and from oil and gas activities, would likely be additive, as opposed to compensatory, except in those areas where the two types of activities overlapped. Impacts to vegetation from exploration and development activities would also be additive, except where development activities occurred in areas previously disturbed during exploration. In areas where two or more activities occurred, overall impacts would reflect those impacts associated with the first activity and any new impacts associated with later activities. As for Alternative A, recovery of tundra vegetation to its original composition from any of the above impacts may be delayed or precluded entirely as a result of simultaneous effects of climate change, i.e., increased shrub height and cover extent, decreased lichen and moss cover, increased thermokarst, and increased inundation of coastal areas by salt water. Such impacts of climate change could accumulate with any changes in soil thermal regimes that might occur as a result of past and future non-oil and gas and oil and gas activities in and near the NPR-A, potentially leading to synergistic impacts to vegetation.

4.6.5.5 Potential Mitigation Measure—Weed-Free Vehicles (new best management practice)

The objective and requirement/standard would be the same as those described in section 4.3.5.5 in Volume 2. The potential benefits and residual/unavoidable impacts would be similar to those described for Alternative A at section 4.3.5.5 in Volume 2.

4.6.6 Wetlands and Floodplains

4.6.6.1 Activities Not Associated with Oil and Gas Exploration and Development

Under Alternative C, impacts to wetlands and floodplains associated with non-oil and gas activities would essentially be the same as those described under Alternative A.

4.6.6.2 Oil and Gas Exploration and Development Activities

Various activities associated with oil and gas exploration, development and production could impact wetlands and floodplains in the NPR-A. These activities include overland moves, seismic operations, exploration drilling, construction of ice roads, ice pads, ice airstrips, gravel roads, gravel pads for pump stations, central processing facilities, gas compressor facilities, and staging bases, airstrips, pipeline construction, gravel mine sites and summer tundra travel.

Exploration

Under Alternative C, activities associated with oil and gas exploration, would impact wetlands and floodplains in a similar manner under Alternative A. Under Alternative C, three more seismic surveys would occur in addition to those under Alternatives A, B-1, and B-2. Short-term wetland vegetation disturbance from 2-D and 3-D operations, combined with transportation, would total a maximum of 718,894 acres. Long-term disturbance is estimated to total 2,453 acres.

There would be a greater number of exploration and delineation wells drilled under Alternative C versus Alternatives A, B-1 or B-2. This would result in an increased number of impacts from well cellar construction, ice pads, ice roads, ice airstrips, and snow trails. During exploration, the additional wells drilled under Alternative C would result in 425,601 acres of short-term disturbance and negligible long-term disturbance.

The construction of well cellars during exploration under Alternative C would amount to less than 0.4 acre.

Development and Production

Various activities associated with oil development and production could cause impacts to wetlands and floodplains in the NPR-A. These activities include construction of gravel pads for pump stations, staging bases and central processing facilities, roads, airstrips, pipelines, excavation of material sites, summer tundra travel, and construction of ice roads. Impacts of ice roads were discussed in Alternative A.

Construction of central processing facilities and gas compressor facilities, and associated satellite pads, roads, and airstrips, would result in the destruction of 9,3429 acres of vegetation in areas where gravel was placed.

The increased number of constructed roads, pads, and facilities under Alternative C would result in a larger area impacted by dust than under the other alternatives. Impacts to plant communities around gravel structures would occur within 164 feet of the structure (Woodward-Clyde Consultants 1983). If all effects were to occur within this zone, an estimated 39,062 acres would be impacted under Alternative C.

Gravel pit excavation and stockpiling of overburden would destroy wetlands at gravel-extraction sites. The location of gravel pits an adequate distance from streams and lakes would minimize these impacts. Under Alternative C, up to 51 gravel pits (1,868 acres) could be required for the development scenario presented in Table 4-14 in Volume 2.

Under Alternative C, impacts from oil and gas pipeline construction would be similar to those described for other alternatives. A detailed discussion of impacts from pipelines to vegetation is in section 4.3.5.2 in Volume 2. Alternative C could disturb up to 27 acres of vegetation through vertical support member placement. Ice roads built for constructing these pipelines would have only short-term impacts to vegetation, as described above for exploration activities, and would affect 3,469 acres. It is assumed that gas pipelines would be buried, so impacts to vegetation would be different than for oil pipelines. This short-term disturbance for gas-gathering lines, regional, and high-pressure gas pipeline would affect 12,188 acres. Total long-term impacts from burial of these pipelines would be 3,657 acres.

Low-ground-pressure vehicles may be permitted to travel off of gravel pads and roads during periods other than when the ground is frozen and covered with snow. This activity is commonly associated with pipeline inspections and spill prevention and preparedness measures required in spill prevention plans during the summer. Impacts under Alternative

C would be similar to those described in Alternatives A , B-1, and B-2, and result in negligible short- and long-term impacts.

Effects of Abandonment and Reclamation

Under Alternative C, impacts to wetlands and floodplains associated with abandonment and reclamation of gravel roads and pads, pipelines, and other facilities would essentially be the same as those described under Alternative A. Alternative C would require reclamation of approximately 13,026 acres, or 53 percent more than the amount in Alternative A.

Effects of Spills and Gas Releases

The greater amount of leasing, development, and production of oil and gas that would occur under Alternative C compared to Alternatives A, B-1, and B-2, would generally result in a greater number of small spills of crude and refined oil, produced water, and seawater in the NPR-A, and a larger number of gas releases due to the increased miles of regional gas pipelines assumed. The probability of a large oil spill occurring would also be slightly greater under Alternative C, but for analysis purposes, it is assumed that only one large spill would occur.

An estimated 11 percent of all spills would occur in the summer and leave gravel pads. This would result in 57 small spills over the life of the plan in Alternative C. Assuming an average spill would cover 0.1 acre, an estimated 6 acres could be impacted over the period of development in Alternative C.

A single gas release occurring with ignition could have thermal effects to approximately 194 acres of tundra vegetation. The assumed number of gas releases under Alternative C would result in thermal effects to approximately 1,203 acres of tundra.

Effectiveness of Stipulations and Best Management Practices

Alternative C would have the same lease stipulations and best management practices as those outlined under Alternatives B-1 and B-2, with the addition of Stipulation K-11, which is not applicable to Alternatives B-1 and B-2 because it would allow no leasing in the area affected by the stipulation. Under Alternative C, development in the NPR-A would result in greater impacts to wetland vegetation and plant communities compared to Alternatives A, B-1, and B-2, due to the greater extent of gravel fill, material sites, and buried gas pipelines. The best management practices and lease stipulations associated with Alternative C would reduce impacts through minimization of vegetation destruction and alteration of plant communities.

Conclusion

Under Alternative C, impacts to wetlands and floodplains from activities other than oil and gas would essentially be the same as those described under Alternative A.

Impacts to wetlands and floodplains from oil and gas exploration would occur from seismic work, construction of ice roads and ice pads, and construction of well cellars during exploratory drilling. The duration and recovery time for impacts associated with seismic work would be similar to those for overland moves. Based on previous studies listed in section 4.3.5.2 in Volume 2, there should be no substantial, long-term impacts to wetlands and floodplains from seismic lines, but camp move trails could substantially impact approximately 2,453 acres after 8 to 9 years. Effects of well cellar construction would also be long-term, but would impact less than 0.4 acre of vegetation.

The effects of oil and gas development and operation would include destruction of wetlands during construction of gravel pads (central processing facilities or gas compressor facilities, satellite drill pads, pump stations, and staging bases), roads, and airstrips, from excavation of material sites and burial of gas pipelines, and construction of vertical support members. These impacts would be long-term and would impact about 14,894 acres of the NPR-A. Plant communities could also be altered by dust deposition, salinity of gravel fill used in construction, snowdrifts, and blockage of or change to natural drainage patterns. These long-term impacts would affect approximately 39,062 acres. Spills of oil, other chemicals, and saltwater could occur, and would have long-term impacts, except for those associated with small-size spills, which would be cleaned up immediately, allowing recovery within a few years to two decades.

The potential for many shallow streams, ponds, and wetlands in the Arctic to dry out under a warming climate is increased by the loss of permafrost. These shallow systems depend on snowmelt as their primary source of water, with rainfall gains often negated by evapotranspiration during the summer. Evaporation from these shallow waterbodies is very likely to increase as the ice-free season lengthens. Hence, the water budget of most lake, pond, and wetland systems is likely to depend more heavily on the supply of spring meltwater from winter precipitation to produce a positive annual water balance, and these systems are more likely to dry out during the summer (ACIA 2004).

Climate change could alter species composition, increasing the prevalence of deciduous shrubs and decreasing the prevalence of wetland sedges and grasses, and could greatly influence wetlands through hydrological changes. Warmer soil temperatures are likely to increase thermokarst and increases in sea level may inundate low-lying tundra areas increasing aquatic and wet tundra vegetation types and increase erosion of coastal bluffs (ACIA 2004). Such impacts of climate change could accelerate or exacerbate changes in soil thermal regimes that occur with oil and gas development, potentially leading to greater and/or cumulative impacts (Walker et al. 1987) to wetlands from changes associated with thermokarst.

Areal extent of short-term impacts under Alternative C would be about 32 percent more than for Alternative A. Areal extent of long-term-term impacts under Alternative C would be about 50 percent more than for Alternative A.

4.6.7 Fish

4.6.7.1 Activities Not Associated with Oil and Gas Exploration and Development

The potential types of effects on fish from non-oil and gas activities under Alternative C would be the same as those described for Alternative A in section 4.3.7.1 in Volume 2; the frequency and intensity of those activities would be expected to be similar.

4.6.7.2 Oil and Gas Exploration and Development Activities

The following discussion addresses the potential effects of oil and gas activities on freshwater, anadromous, and marine fish and fish habitat found within the NPR-A under Alternative C.

Effects of Seismic Surveys

The potential types of effects on fish from seismic surveys under Alternative C would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2.

Under Alternative C, effects of seismic surveys on freshwater, anadromous, or marine fish should be localized and primarily impact individual fish in a specific lake or other overwintering location. It can be assumed that the more miles that are surveyed under any given alternative, the greater the probability that effects on fish may occur. The incidence of impacts on fish occurring from seismic surveys under Alternative C (70,906 surveying miles) would be 31 percent more than Alternative A, 22 percent more than Alternative B-1 and B-2, and 9 percent less than Alternative D.

Effects of Snow Trails, Ice Roads, Ice Pads, and Ice Airstrips

The potential types of effects on fish from snow trails, ice roads, ice pads, and ice airstrips under Alternative C would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2.

Under Alternative C, effects on freshwater, anadromous, and marine fish from snow trails, ice roads, ice pads, and ice airstrips, and the associated activities that take place on this temporary infrastructure, such as vehicle travel, industrial equipment transport and use, exploratory drilling, and supporting work camps, would likely be localized to a number of discrete locations. Across different alternatives, the anticipated length of ice roads and snow trails is a reasonable relative index of potential effects on fish from winter oil and gas activities. The greater the transportation network, the more supporting infrastructure and associated activities. From this perspective, the expected incidence of impacts on fish from winter oil and gas activities under Alternative C (102,689 ice road or snow trail miles) would be 33 percent more than Alternative A, 86 percent more than Alternative B-1, 78 percent more than Alternative B-2, and 6 percent less than Alternative D.

Effects of Water Demand

The potential types of effects on fish from water demand under Alternative C would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2.

Under Alternative C, considering the protective guidelines and the number of studies investigating both freshwater and seawater uses, effects of water demand on freshwater, anadromous, or marine fish should be limited to local, short-term impacts. In evaluating all alternatives, the relative comparison of projected ice infrastructure should be directly related to the expected incidence of impacts on fish from winter water use. Consequently, Alternative C (434,133 acres of ice pads, ice airstrips, and ice roads or snow trails) would have an incidence of impacts that is 33 percent greater than Alternative A, 86 percent greater than Alternative B-1, 33 percent greater than Alternative B-2, and 13 percent less than Alternative D. The more production pads anticipated under an alternative, the greater the need for year-round freshwater for personnel camps. The degree of foreseeable impacts on fish from year-round domestic freshwater demand under Alternative C (148 oil and gas production pads) would be 44 percent more than Alternative A, 97 percent more than Alternative B-1, 80 percent more than Alternative B-2, and 8 percent less than Alternative D. The year-round need for seawater for waterflooding would be proportional to the number of oil production pads that would exist for an alternative. The probable extent of potential impacts on fish from year-round seawater use under Alternative C (15 oil production pads) would be 6 percent less than Alternatives A and D and 7 percent more than Alternative B-1 and B-2.

Effects of Gravel Mining

The potential types of effects on fish from gravel mining under Alternative C would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2.

Considering the well-understood impacts associated with instream and floodplain gravel mining, regulations associated with this activity, and the generally positive results demonstrated in other North Slope oil field gravel mines, negative effects on freshwater, anadromous, or marine fish under Alternative C would likely be localized to small drainages where gravel pits are constructed. Foreseeable potential impacts on fish due to gravel mining would be proportional to the maximum number of gravel pits expected under each alternative. The extent of impacts under Alternative C (52 or fewer gravel pits) would be 30 percent more than Alternative A, 79 percent more than Alternative B-1, 68 percent more than Alternative B-2, and 5 percent less than Alternative D.

Effects of Development Pads, Roads, Airstrips, and Pipelines

The potential types of effects on fish from development pads, roads, airstrips, and pipelines under Alternative C would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2. Also, the same as Alternative B-1 and B-2, under Alternative C Teshekpuk Lake and a large area around it; Kasegaluk Lagoon and Peard Bay and a mile-wide area around them; and Elson Lagoon, Dease Inlet, and Admiralty Bay would not be available for oil and gas leasing and new non-subsistence infrastructure would be prohibited.

Under Alternative C, effects on fish from development pads, roads, airstrips, and pipelines, and associated activities such as vehicle and equipment traffic, personnel camps, and production drilling, should primarily occur in different areas at a small catchment scale; impacts would not be expected to have a significant effect on larger watershed populations of freshwater, anadromous, or marine fish in the NPR-A or adjacent waters. The anticipated length of roads and pipelines is representative of the relative scale of expected development under each alternative. From this standpoint, the incidence of impacts on fish from those structures and associated activities under Alternative C (3,820 miles of roads and pipelines) would be 67 percent more than Alternative A, 102 percent more than Alternative B-1, 86 percent more than Alternative B-2, and 3 percent less than Alternative D. The incidence of impacts on fish related to gravel pads and airstrips under Alternative C (213 gravel pads and airstrips) would be 37 percent more than Alternative A, 88 percent more than Alternative B-1, 76 percent more than Alternative B-2, and 7 percent less than Alternative D.

Effects of Causeways

The potential types of effects on fish from causeways under Alternative C would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2.

Under Alternative C, causeways or any other structures that extend into coastal waters could impact anadromous or marine fish along local coastline areas. Under the different alternatives, susceptibility to causeway effects can be based on the estimated length of coastline within available leasing areas for each alternative (Table 4-19 in Volume 2). From this perspective, 50 percent of the NPR-A coastline (600 miles) would be vulnerable to causeways under Alternative C. Comparatively, causeways could potentially be built along 100 percent of NPR-A coastline under Alternatives A and D and less than 10 percent of the coastline under Alternative B-1 and B-2. However, under Alternatives C, A, and B-1 (Lease Stipulation K-8b), Kasegaluk Lagoon would be off-limits to permanent oil and gas facilities, while under Alternatives D and B-2, a causeway or similar structure could be constructed there.

Effects of Summer Tundra Travel

The potential types of effects on fish from summer tundra travel under Alternative C would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2.

Under Alternative C, limited summer tundra travel could affect freshwater or anadromous fish in a number of discrete lakes and streams, but would not likely have any impact on marine fish. Since most approved summer tundra travel would be related to pipeline maintenance, the length of pipelines estimated for each alternative is indicative of the relative extent of potential effects on fish from this activity. Accordingly, the expected incidence of impacts under Alternative C (2,849 miles of all pipelines) would be 80 percent more than Alternative A, 104 percent more than Alternative B-1, 90 percent more than Alternative B-2, and 2 percent less than Alternative D.

Effects of Oil Spills and Gas Releases

The potential types of effects on fish from oil spills and gas releases under Alternative C would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2. Also the same as Alternative B- 1 and B-2, under

Alternative C, Teshekpuk Lake; Kasegaluk Lagoon and Peard Bay and a mile-wide area around them; and Elson Lagoon, Dease Inlet, and Admiralty Bay would not be available for oil and gas leasing, and new non-subsistence infrastructure would be prohibited.

Under Alternative C, effects on freshwater, anadromous, or marine fish from small crude or refined oil spills and from any gas release should typically be localized. Most gas releases would only present an acute, short-term threat to fish; impacts from liquid (oil and other produced fluid) spills would be much greater. Since most Alaskan North Slope industry spills have been contained on gravel pads and roads (National Research Council 2003), pipeline leaks would be the most likely source for spills that could affect fish. Consequently, the estimated extent of pipelines that would transport liquids under each alternative represents a practical relative risk to fish from small spills. The risk under Alternative C (2,439 miles of pipeline for oil and two- or three-phase produced fluids) would be 81 percent more than Alternative A, 131 percent more than Alternative B-1, 110 percent more than Alternative B-2, and 2 percent less than Alternative D.

Effects on fish from large oil spills, if a substantial portion reached freshwater, could impact freshwater and anadromous fish populations at a watershed level. If a considerable quantity of a large oil spill reached coastal waters, this could potentially impact anadromous or marine fish populations. The percent chance of one or more large oil spills (Table 4-16 in Volume 2) under Alternative C (37 percent) is the same as Alternative A (37 percent), Alternative B-1 (28 percent), more than Alternative B-2 (30 percent), and less than Alternative D (39 percent).

Effects of Abandonment and Reclamation

The potential types of effects on fish from abandonment and reclamation under Alternative C would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2.

Effects (negative or positive) on freshwater, anadromous, or marine fish from oil and gas abandonment and reclamation under Alternative C should only occur at individual lakes, small stream reaches, or limited coastline areas. The total area of surface disturbance under the different alternatives should reflect the relative magnitude of potential effects on fish from abandonment and reclamation. As such, Alternative C (27,369 acres of permanent pads, roads, pipelines, and gravel pits) would have an expected incidence of impacts that is 65 percent more than Alternative A, 104 percent more than Alternative B-1, 86 percent more than Alternative B-2, and 4 percent less than Alternative D.

4.6.7.3 Effectiveness of Stipulations and Best Management Practices

The best management practices and lease stipulations under Alternative C would mitigate potential impacts on fish from oil and gas activities to the extent that effects would likely occur in localized areas and only a large oil spill would be expected to potentially affect fish at the population level. The effectiveness of these best management practices and lease stipulations would be the same as described under Alternative B-1 in section 4.4.7.3 in Volume 2.

4.6.7.4 Conclusion

The potential impacts to freshwater, anadromous, and marine fish from oil and gas exploration and development activities within the NPR-A under Alternative C broadly include acoustic disturbance, injury at water-use intakes, altered water quality, physical habitat changes (water quantity, flow patterns, and geomorphology), point and non-point source pollution, increased turbidity and sedimentation, and barriers to fish movements. These impacts can collectively contribute to reduced success at different life history stages, behavioral changes, diminished condition, susceptibility to pollutants or disease, shifts in fish species distribution, and mortality. The best management practices and lease stipulations in Alternatives B-1, B-2, C, and D, and the corresponding required operating procedures and lease stipulations in Alternative A would essentially provide the same level of protection to fish. The major exception is that Alternative D has no comparable provisions to Lease Stipulations K-3a and K-3bin Alternatives A, B-1, B-2, and C and Alternatives D and B-2 have no comparable provision to Lease Stipulation K-8b in the other alternatives.

The fundamental difference among the various alternatives regarding potential effects on fish is the extent of land that would be open for leasing to conduct oil and gas activities and the distribution of those lands within the NPR-A Fish Habitat Units (Map 3.3.4-1; Table 4-19 in Volume 2). Under Alternative C, NPR-A lands available for leasing include 25,600 miles of potential stream habitat. This is 44 percent more than Alternative A, 57 percent more than Alternative B-1, 48 percent more than Alternative B-2,, and 25 percent less than Alternative D. The amount of potential lake habitat within lands that may be leased in Alternative C (1,651,400 acres of lake surface area) is 2 percent more than Alternative A, 64 percent more than Alternative B-1, 65 percent more than Alternative B-2, and 12 percent less than Alternative D. The distribution of these waterbodies in different NPR-A Fish Habitat Units is described in Table 4-19 in Volume 2.

If predicted shifts in physical and chemical characteristics of the environment occur with climate change (e.g., Scenarios Network for Alaska Planning 2010), impacts on fish from oil and gas activities under Alternative C could be greater or less than expected. The factors related to this are the same as those described for Alternative A.

4.6.7.5 Potential New Mitigation Measure (new best management practice)

The objective and requirement or standard would be the same as those described in section 4.3.7.5 in Volume 2. The potential benefits and residual or unavoidable impacts would be similar to those described for Alternative A in section 4.3.7.5 in Volume 2.

4.6.8 Birds

This section discusses the potential direct and indirect effects to non-special status bird species that could result from management actions in the NPR-A under Alternative C; a discussion of effects to threatened and sensitive bird species is given in section 4.5.11, “Special Status Species.” Most of the activities that could potentially affect birds in the planning area would result from oil and gas exploration and development. Other activities that could potentially affect birds in the planning area include permitted recreational use, guided hunting, activities associated with scientific surveys and research camps, cleanup of old oil and gas exploration sites, and activities associated with government actions (e.g., cleanup of abandoned well sites). These activities could affect tundra-nesting birds by causing: (1) habitat loss, (2) disturbance or displacement, (3) increased predation, and (4) direct mortality. Impacts would most often be localized and on the scale of individual birds. Impacts have potential to have greater negative effect if the activity occurs in an area of high bird density (such as near lakes containing large numbers of molting geese or shorebird nesting and staging areas) or in areas containing populations of species known to have declining populations or those particularly sensitive to disturbance. Alternative C would make available approximately 76 percent (17.9 million acres) of the NPR-A for oil and gas leasing, although leasing in lands currently deferred from leasing (see Alternative A) would not be offered for lease pending expiration of the deferrals (see Map 2-3). Approximately 4.4 million acres in the far south of the planning area, Kasegaluk Lagoon Special Area, and the major coastal waterbodies of Elson Lagoon, Dease Inlet, Admiralty Bay, and Wainwright Inlet/Kuk River would be unavailable for leasing and a new special area (Peard Bay Special Area) would be created. Management practices would emphasize performance-based stipulations and best management practices on surface activities, consultation with local residents, and coordinated scientific studies to protect wildlife habitat, subsistence use areas, and other resources.

4.6.8.1 Activities Not Associated with Oil and Gas Exploration and Development

Under Alternative C, activities not related to oil and gas exploration and development that could affect birds in the planning area would be the same as those described under Alternative A: air traffic, aerial surveys to inventory wildlife or other resources, summer research activities, hazardous material or debris removal, and permitted recreational camps and boating activity. As compared to Alternative A, impacts to birds from non-oil and gas activities could be more frequent, greater in extent, or longer in duration under Alternative C. This is because the greater amount of oil and gas activity projected in this alternative may increase the amount of non-oil and gas activity by increasing the impetus for scientific studies. More individual animals likely would be exposed to human activities, including aircraft traffic and aerial surveys. Impacts generally would be localized, and the disturbance reactions of birds would likely be brief, lasting for a few minutes to an hour. Some birds might avoid scientific and recreation camps during the 6 to 12 weeks of activities, while some birds (e.g., ravens) could be attracted to the camps. Best management practices (see Alternative A for specifics) and large areas in which new non-subsistence permanent infrastructure is prohibited protect birds and their habitats, and would help to mitigate the potential effects of non-oil and gas activities on birds under Alternative C.

4.6.8.2 Oil and Gas Exploration and Development Activities

Exploration

Ground-based seismic surveys and exploration activities would occur during the winter months, when birds are mostly absent from the planning area. Under Alternative C, the types of effects of winter exploration activities would be the same as those discussed under Alternative A. Approximately 23 percent more area would be covered by seismic surveys in Alternative C as compared to Alternative A, and the number of surveys would increase to 14 from the 11 estimated for Alternative A. The use of air guns for boat-based seismic work would not be allowed in several large coastal bays and lagoons because of restrictions in

Stipulation K-3b (Dease Inlet, Admiralty Bay, Elson Lagoon, Peard Bay, Wainwright Inlet/Kuk River, Kasegaluk Lagoon, and their associated islands). This is a larger total area protecting birds from air gun disturbance than provided under Alternative A. This alternative does not provide protection via Stipulation K-3b to the Kogru River (an important molting and fall staging area for geese) which may allow for greater development requiring a greater amount of seismic work. The direct effects of ground-based exploration activities would likely include the temporary displacement of a small number of birds (e.g., ptarmigan and gyrfalcons) from preferred winter feeding or roosting areas.

Alternative C prohibits exploration activities in the same areas and manner as Alternative A (i.e., in Dease Inlet, Admiralty Bay, Elson Lagoon, and associated islands). However, unlike Alternative A, it adds other high-quality bird habitats to the prohibition. These include Peard Bay, Kasegaluk Lagoon, and Wainwright Inlet/Kuk River. These areas are very important to many migratory species of waterbirds and shorebirds during critical life stages such as migration staging, molting, and breeding, and therefore, birds would benefit greatly from the protection. It should also be noted that Alternative C makes the above listed lands unavailable for leasing thus decreasing the probability that seismic activities would occur. During winter, when exploration activities would be allowed (but no shorebirds or waterbirds are present), indirect impacts could result from the construction of ice roads and ice pads, and the associated water withdrawal. The types of effects that could result from the construction and use of ice roads and ice pads would be the same under Alternative C as those described under Alternative A, and would primarily involve the temporary alteration of tundra habitats. Approximately 25 percent more area would be available to oil and gas exploration activities under Alternative C, as compared to Alternative A. Therefore, the potential impacts to birds resulting from exploratory activities would likely be greater under Alternative C than under Alternative A, and would be even higher relative to Alternatives B-1 and B-2.

Alternative C contains the same measures as all other alternatives to avoid human-caused increases in predator populations. This includes Required Operating Procedure/Best Management Practice A-2 and Stipulation E-9, which would minimize the availability of anthropogenic food (e.g., garbage) and shelter, respectively that could be utilized by predators. Similarly, measures addressing proper handling of hazardous materials associated with the drilling process and accidental spills are the same among all alternatives as well (i.e., Required Operating Procedures/Best Management Practices A1 through A-7). Therefore, Alternative C offers no advantage or disadvantage to birds from the handling of waste products.

Under Alternative C, oil and gas exploration wells would create an estimated combined short-term ground disturbance of 708 acres, and a long-term ground disturbance of less than 1 acre. Delineation wells would impact the same number of acres, although not necessarily in the same locations as the exploration wells. This amount of short-term bird habitat loss is approximately 20 percent greater than what is predicted for Alternative A. There is essentially no long-term habitat loss predicted from exploration activities in any alternative.

Under Alternative C, moderate effects to birds from exploration activities could occur in the goose molting area, the entire area of which would be deferred from leasing until 2018 under Alternative A. However, Stipulation K-4a would mitigate some potential impacts by prohibiting water extraction and other oil and gas activities that could affect goose-feeding habitat along lakeshore margins. Currently, there is little known as to why geese use the goose molting area in such large concentrations, and impacts to vegetation or impoundments and delayed drainage due to ice roads may have a negative effect on the habitat used by molting geese.

Development and Production

Under Alternative C, the types of development and production activities would be the same as those discussed under Alternative A. In order to mitigate the potential negative effects of activities associated with the oil and gas development and production activities, Alternative C includes Stipulations E-2, G-1, K-2, K-3a and b, K-4a, K-6, K-9, K-10 and K-11. Stipulations K-4a and K-6 in Alternative C offer greater protection to birds than do the corresponding stipulations in Alternative A. However, because the amount and location of activities could be different under Alternative C, effects to birds could also vary, as discussed in detail below.

Habitat Loss

Of all activities, gravel mining and placement for the construction of oil and gas field infrastructure would have the greatest potential to result in the permanent loss of bird habitat. Under Alternative C, it is estimated that a total of 830 acres would be disturbed for oil central processing facilities and gas compressor facilities (see Table 4-14 in Volume 2). In conjunction with these facilities, other support structures would also be needed, such as gravel production pads, runways, and roads. Under Alternative C, the gravel footprint (total long-term disturbance) of these production facilities would be 14,894 acres (see Table 4-14 in Volume 2). Alternative C is predicted to create a greater amount of long-term surface disturbance than any other alternatives except for Alternative D.

In addition to permanent habitat loss, temporary loss of tundra habitat adjacent to gravel roads and pads could occur as a result of thermokarst, dust deposition, snow accumulation, water withdrawals (if recharge does not occur), and impoundment formation. Under Alternative C, the types of effects to birds resulting from temporary habitat loss would be the same as those discussed under Alternative A. However, the potential for temporary loss would likely be greater under Alternative C than under any other alternatives except for Alternative D, due to the greater amount land available for leasing, likely resulting in an increased need for pads, pipelines, roads, and associated infrastructure. The extent of effects to birds from temporary habitat loss would depend on the species and numbers of individuals occurring in areas adjacent to the development.

Bird mortality could result from collisions with vehicles (ground and air) or structures such as elevated pipelines; buildings; drilling rigs; towers; power lines, if suspended; boats (including barges); or bridges. Under Alternative C, the types of effects to birds resulting from collisions with structures would be the same as those discussed under Alternative A. Although, the potential for collisions would be greater under Alternative C than any other alternatives except for Alternative D, due to the greater amount land available for leasing, likely resulting in an increased need for pads, pipelines, roads, and associated infrastructure. The magnitude of potential impacts to bird populations, as a result of collisions in areas of oil and gas development, will depend, among other variables, on the location and type of the structure, the species involved, the lighting regime employed, and the weather conditions. Birds would likely be impacted at the level of the individual and not at a population level.

Disturbance

The potential for disturbance to birds from ground-based travel on roads, within pads, and cross-tundra would likely be greater under Alternative C, than under Alternative A. After the expiration of the 2018 deferral, Alternative C would provide about 20 percent more lands available for oil and gas leasing (including a large tract of important bird habitat east of Dease Inlet and around Teshekpuk Lake), resulting in an increased need for pads, pipelines, roads, and associated infrastructure. Potential impacts from summer cross-country travel on tundra would be limited in Alternative C the same as all other alternatives, and would only be allowed on a case-by-case basis, and only after extensive studies have been conducted (Required Operating Procedure/Best Management Practice L-1).

Aircraft, both fixed-wing and helicopter, would provide access for oil and gas-related activities throughout the development, operation, and abandonment of any oil or gas field developed in the NPR-A. The types of disturbance effects to waterfowl and other bird groups from aircraft would be the same under Alternative C as those discussed under Alternative A, and could include displacement from preferred feeding habitats, temporary or permanent nest abandonment, and temporary or permanent displacement from staging, molting, or brood-rearing areas. Aircraft disturbance would likely affect birds in those portions of the NPR-A open to development, with the effects being lowest in Alternatives B-1 and B-2, third lowest in Alternative A, with more disturbance likely to occur in Alternative C, and the most disturbance likely to occur in Alternative D.

The types of disturbance effects to waterfowl and other bird groups from watercraft would be the same under Alternative C as those discussed under Alternative A, and could include displacement from preferred habitats and nest abandonment. As the expected number of sealifts in Alternative C would be higher than in Alternative A, the impacts from bird collisions with barges would also be higher in Alternative C.

Oil spill response training activities using watercraft could be conducted on rivers and lakes several times during the open-water season. The potential for disturbance to birds from these activities would likely be greater under Alternative C than under Alternative A due to the greater amount land available for leasing, likely resulting in an increased need for pads, pipelines, roads, and associated infrastructure. The extent of effects to birds from oil spill and gas release response activities would depend on the species and numbers of individuals occurring in areas within and adjacent to the impacted area.

Under all alternatives, the goose molting area would be deferred from leasing until 2018, after that time Alternative C would provide protections to molting geese in the Goose Molting Area using Stipulation K-4a while the area would be unavailable for leasing in Alternatives B-1 and B-2. Compared to the other alternatives, Stipulation K-4a would provide a much reduced level of protection in Alternative D. After the 2018 deferral has expired Alternative B-1 will provide the greatest protection to molting geese while Alternatives B-2 and C would both provide strong (although slightly different) protections under Stipulation K-4a.

Predation

Some predators, such as ravens, gulls, arctic foxes, and bears could be attracted to areas of human activity where anthropogenic sources of food and denning or nesting sites were present. The potential impacts of increased numbers of predators on birds are discussed under Alternative A. Increased predation pressure could have moderate impacts on tundra-nesting birds. Under Alternative C, the types of effects to bird populations would be the same as those discussed under Alternative A. Under Alternative C, there would be greater potential for bird mortality due to predation than under Alternative A, as there would be more human activity and anthropogenic sources of food available.

Abandonment and Reclamation

Development scenarios indicate that at abandonment of the field, gravel pads and roads may or may not be removed and that reclaimed or abandoned pads may be revegetated by native vegetation or would be allowed to bed naturally. Given that scenario, it is very difficult to determine potential effects to birds from these unknown activities. For this document, it is assumed that all gravel will be removed after abandonment. Given that assumption, the impacts of abandonment and reclamation of oil and gas fields on birds would be similar in many respects to those incurred by construction activity. The types of impacts would be the same for Alternative C as described in Alternative A. Impacts would likely be greater for Alternative C than for Alternative A, as more area would be available for oil and gas development in Alternative C, resulting in a greater total area to be abandoned and subsequently reclaimed.

Oil Spills and Gas Releases

Under Alternative C, the types of and effects to birds from oil and seawater spills and gas releases would be the same as those discussed under Alternative A.

Although the estimated large spill volume is the same for all alternatives, the probability of a spill occurring varies little among Alternatives A, C, and D (37, 37, and 39 percent chance of a large spill, respectively), while Alternative B-1 and B-2 are estimated to have a 28 and 30 percent chance of a large spill, respectively. Even with the protection of particularly sensitive areas (e.g., coastal shoreline and goose molting area), and the substantial emphasis on spill prevention and response, if a large crude oil spill occurred, it could have a measurable effect on birds at a population level. Effects to individual birds could range from short-term disturbance to death. Impacts to birds on a population level could occur if oil from a large spill entered rivers, important molting or brood-rearing lakes, or marine areas during periods when large proportions of specific populations (e.g., brant, long-tailed ducks, eiders, and shorebirds) were present. Many factors would determine the probability that birds would be negatively impacted by a large oil spill, including the quantity spilled, season, location (e.g., land versus water), and proximity to sensitive habitat. Although the probability of a spill varies by alternative, the impacts to individual birds from large crude or refined oil spills would be the same as under all alternatives if a spill were to occur in a location where birds were present.

Oil entering a river or stream could potentially spread into delta or coastal areas, where impacts to loons, waterfowl, and shorebirds could be more severe. Under all alternatives, the potential that an oil spill would enter a major river or stream would be minimized by Stipulation K-1. This would provide setbacks from specified rivers, within which permanent oil and gas facilities would be prohibited, although pipelines would not necessarily be prohibited in some of these areas.

Oil spilled (from a barge or support vessel) into marine habitats would have the potential to spread oil over a larger area than in terrestrial habitats due to winds and currents; therefore, birds found in marine habitats within the NPR-A could be particularly susceptible to the negative impacts of an oil spill. The greater need for marine transportation under Alternative C relative to Alternative A would increase the opportunity for a spill to occur. For further discussion of potential effects of marine spills, see Alternative A.

A gas release from a well is expected to last one day and to release 10 thousand cubic feet of gas, while a release from a transmission pipeline or processing facility is estimated to release 20 thousand cubic feet over a few hours. Although the estimated release volume is the same for all alternatives, the difference in the estimated number of gas production wells and lengths of various pipelines would change the probability of a release among the alternatives. The potential for disturbance to birds from a gas release would likely be greater under Alternative C, as compared to Alternative A, due to the greater amount land available for leasing, likely resulting in an increased need for pads, pipelines, roads, and associated infrastructure.

4.6.8.3 Effectiveness of Stipulations and Best Management Practices

Alternative C makes 75 percent of the NPR-A available for oil and gas leasing while providing the creation of a new special area (Peard Bay) and retention of the other existing special areas, recommendation to Congress that three rivers be designated for inclusion in the Wild and Scenic Rivers System as scenic, and numerous surface protections. Unavailable lands and lands designated as special areas result in the protection of many natural resources, including birds and bird habitat.

Alternative C would make approximately 4.4 million acres in the Utukok River Uplands Special Area unavailable for oil and gas leasing. Lands north and northeast of Teshekpuk Lake would be protected through 2018 due to the deferral currently in effect. Other lands would be unavailable for leasing in Alternative C to protect marine habitat and shorelines important for marine animals, waterfowl, and shorebirds (Elson Lagoon, Dease Inlet, Admiralty Bay, Wainwright Inlet/Kuk River, Peard Bay, and Kasegaluk Lagoon, and their associated barrier islands and, in the case of Peard Bay and Kasegaluk Lagoon, lands within 1 mile of those two waterbodies). This unavailable designation supersedes the current time-limited (2014) deferral for the Kasegaluk Lagoon Special Area.

Alternative C would place 9 million acres in special areas, increasing the size of the Utukok River Uplands Special Area and adding the 107,000-acre Peard Bay Special Area. The boundary of the Colville River Special Area would not change, but its purpose would be modified as explained in Alternative A.

All alternatives, including Alternative C, contain numerous stipulations and best management practices that would effectively protect birds and their habitats in the NPR-A (see Alternative A for a full listing). The "B" best management practices would help limit the impact of water withdrawals on lakes, or lake habitats, used by birds, while the "C" required operating procedures govern seismic ground operations to prevent seismic activity-related disturbance to birds and provide protection for over-wintering fish and invertebrates, which are sources of food for many birds. The goose molting area within the Teshekpuk Lake Special Area is protected by Stipulation K-4a, which under Alternative C prohibits permanent oil and gas facilities (except pipelines) within 1 mile of the shorelines of goose molting lakes. In addition, there are numerous best management practices and stipulations that regulate the types of activities that can occur near waterbodies, including rivers and streams; types of equipment that can be used; and types of exploration and development activities that can be conducted in the planning area to protect birds and their habitats.

Finally, Alternative C provides stipulations and best management practices that provide protection to surface resources that are nearly identical to those in Alternatives B-1 and B-2, and superior to those in Alternative A. Alternative C allows for 76 percent of the NPR-A to be leased while Alternatives A, B-2, and B-1 allow for 57, 52, and 48 percent, respectively. As there has been no oil or gas development yet in the NPR-A, it is difficult to determine the effectiveness of the above-mentioned best management practices and stipulations. Required operating procedures and stipulations that have been in effect in the NPR-A to date regulate exploratory activities, and thus far, seem to be effective in protecting birds and bird habitats.

4.6.8.4 Conclusion

Alternative C emphasizes the protection of surface resources, through best management practices and stipulations, at the same level as Alternatives B-1 and B-2, although less land would be made unavailable in Alternative C than in B-1 and B-2. Alternative C would make 4.4 million acres unavailable in the Utukok River Uplands Special Area, increasing protection for habitat for waterfowl, shorebirds, and loons compared to Alternative A, and would protect important habitats for shorebirds using uplands. Alternative C would allow more infrastructure into areas of very high value to birds than Alternative A, and in this aspect, would be less protective than Alternative A, perhaps resulting in an increased need for infrastructure that could cause habitat loss, disturbance, or mortality. A corridor for infrastructure associated with offshore development in the Chukchi Sea could be accommodated.

Alternative C would provide five special areas, including the creation of one new special area and the enlargement of two others (as compared to Alternative A), making 9 million acres of land unavailable for oil and gas leasing. The 1.6-million-acre Peard Bay Special Area would be created with an explicit purpose of protecting nearshore waters for shorebirds and waterbirds. The purpose of two existing special areas would be modified to specifically include birds.

Non-oil and gas activities that could potentially affect birds would be the same as those in Alternative A. Under all alternatives, this analysis shows that impacts birds from non-oil and gas activities would be minor.

A greater level of development would likely occur under Alternative C, as compared to Alternative A. After the deferral expires in 2018, the potential for habitat loss and alteration to affect birds would be greater under Alternative C, as compared to Alternative A, as the amount of high-use bird habitat that would be lost to gravel infrastructure would be greater, and there would be a higher potential for infrastructure to be located in areas of high bird use in the Teshekpuk Lake Special Area. Stipulations and best management practices established for Alternative C would help to mitigate potential impacts to tundra-nesting birds. The potential for bird mortality resulting from collisions with vehicles (air or ground) or infrastructure and marine vessel traffic would be greater under Alternative C, because the amount of infrastructure and barge traffic would be greater than in Alternative A. The potential for an oil spill to impact birds would also be greater under Alternative C, as compared to Alternative A, given the estimated greater amount of infrastructure and development activity in this alternative.

Under Alternative C, the types of disturbances related to vehicle, aircraft, pedestrian, and vessel traffic, routine maintenance activities, heavy equipment use, facility noise, and oil spill and gas release clean-up activities would be similar to those described under Alternative A. Under Alternative C, types of impacts to birds would be similar to those discussed under Alternative A, but would be greater in frequency and extent because of the high oil and gas potential of the northern portion of the NPR-A, and the potential for greater development to occur, including in areas currently off-limits to surface development activities. After the expiration of the 2018 deferral, it is expected that impacts to birds in the vicinity of Teshekpuk Lake and throughout the northern portion of the planning area would be least under Alternatives B-1 and B-2, greatest under Alternative D and about equal under Alternatives A and C, particularly with respect to molting waterfowl. Stipulations and best management practices established under Alternative C would help to mitigate potential impacts to birds. Effectiveness of stipulations and best management practices is unknown at this time, but they are presumed to be effective.

Stipulations and best management practices established under Alternative C would help to mitigate potential impacts to birds. Effectiveness of stipulations and best management practices is unknown at this time, but they are presumed to be effective.

In general, impacts to birds from non-oil and gas activities, and from oil and gas exploration and development activities, would be additive. Potential impacts from seismic activity would vary by alternative with Alternative A expecting to require five exploratory and six developmental seismic surveys (see Table 4-11 in Volume 2). Alternative C is estimated to require 14 total seismic surveys, which will cover a greater area than would be covered in Alternative A. The expected number of oil and gas fields and the level of development under Alternative C would be greater than under Alternative A. Therefore, it is expected that the potential effects of disturbance, habitat loss and alteration, and bird mortality due to oil and gas exploration and development under Alternative C would be greater than under Alternative A. The sum of effects from all activities authorized under this alternative, barring a large oil spill, would likely produce no measureable effect on migratory bird populations of any species. All alternatives would minimize unintentional take of migratory birds and conserve migratory bird populations.

Although many of the forces driving global climate regime shifts may originate outside the Arctic, the impacts of global climate change are exacerbated in the Arctic (Arctic Climate

Impact Assessment 2004). Temperatures in the Arctic have risen faster than in other areas of the world, as evidenced by glacial retreat and melting sea ice. Given that, bird species whose range in Alaska is concentrated in the Arctic may be the most vulnerable to the effects of a changing climate. These species include snow goose, king eider, red phalarope, stilt sandpiper, ruddy turnstone, pomarine jaeger, snowy owl and Smith's longspur, among others. Effects to birds from climate warming may include a suite of effects, both positive and negative. A longer open-water season may increase productivity of some species of shorebirds and increase productivity in aquatic and semi-aquatic systems, which provide food for many species of birds.

Warmer soil temperatures are likely to increase thermokarst, and increases in sea level may inundate low-lying tundra areas, increasing salt marsh, aquatic and wet tundra vegetation types, and erosion of coastal bluffs (Arctic Climate Impact Assessment 2004) causing changes in coastal habitats that may quickly result in changes in vegetation that influence habitat suitability and availability for birds (Mars and Houseknecht 2007). The increasing thickness of the active layer of soil above arctic permafrost is likely to cause changes in moisture regimes and the distribution of vegetation types over much of the Arctic in coming years. Drying of wetlands would result in negative effects to those species that relay on shallow water and wet meadows, and shrub expansion may reduce the quality and availability of some types of habitats. Such impacts could accelerate or exacerbate changes in soil thermal regimes that occur with development, potentially leading to greater impacts to bird habitat.

Melting sea ice may affect a few bird species, such as black guillemot that feed near the ice edge, which may not be able to bring high-quality food to their young as the pack ice moves further offshore. Increase in human economic activities such as shipping and offshore oil and gas development may influence the abundance and distribution of predators, which may negatively affect bird populations. These changes may be beneficial to some species, such as those associated with boreal forest or shrub habitats, but a reduction in the amount of tundra habitat available could negatively impact tundra-nesting shorebirds and waterfowl, and add to the cumulative effects of oil and gas development. High rates of coastal erosion and storm surges have led to saltwater intrusion into freshwater habitats, and such intrusions are expected to have altered goose foraging habitats, and may be the cause of the observed spatial redistribution of geese in the Teshekpuk Lake Special Area (U.S. Geological Survey 2006).

4.6.9 Terrestrial Mammals

4.6.9.1 Activities Not Associated with Oil and Gas Exploration and Development

Impacts to mammals from non-oil and gas activities would essentially be the same as those discussed under Alternative A. No further analysis is necessary.

4.6.9.2 Oil and Gas Exploration and Development Activities

Alternative C would make 17.9 million acres (76 percent of federal subsurface lands in NPR-A) available for oil and gas leasing and exploration. In addition, lease stipulations would provide seasonal and spatial protection to certain environmentally sensitive areas, including Rivers Area, Deep Water Lakes, Colville River Special Area and Coastal Area, and Teshekpuk Lake. The exploration scenario under Alternative C assumes that two 2-D and twelve 3-D seismic surveys would be conducted over the next 30 years, an increase of three surveys over Alternatives A, B-1 and B-2, and involving 55 percent more acreage than in Alternative A. It also assumes that 244 oil or gas exploratory or delineation wells, 24 percent more than those assumed under Alternative A, would be drilled from winter ice pads over that period. The development scenario under Alternative C assumes that 12 central processing facilities for oil and 39 central processing facilities or gas compressor facilities for gas, along with associated production pads and other facilities would be developed in the NPR-A. The exposure of terrestrial mammals to oil and gas activities, and therefore, the level of associated impact, would be greater under Alternative C than under Alternative A, and even greater yet than Alternative B-1 or B-2, given that the overall scale of development is assumed to be greater under Alternative C.

Effects of Disturbances

Seismic Activities

Impacts to terrestrial mammals under Alternative C would be greater than those under Alternative A, since it is assumed that the number of terrestrial seismic operations would increase by 27 percent and would involve 55 percent more acreage. These could occur over an area available for leasing that would be 38 percent greater than for Alternative A. It is expected that the reactions of caribou and other terrestrial mammals to disturbance would be brief, although large numbers of wintering Teshekpuk Caribou Herd caribou could be encountered, depending on the location. Some caribou and other large mammals would likely be displaced from the general area of the seismic work. Some terrestrial mammals would avoid seismic camps, while others, such as foxes, could be attracted to the camps by food odors. The potential for disturbance to hibernating grizzly bears would remain, and seismic surveys under Alternative C could occur in much of the Utukok River Uplands Special Area, where bear density is greater. Impacts to moose would likely be the same as for Alternative A, since there would be no change for the Colville River area where most NPR-A moose winter. Impacts to muskoxen would likely be greater, since there may be some wintering, mixed-sex groups in the portion of the Utukok River Uplands Special Area available for leasing.

Under Alternative C, Teshekpuk Lake would not be available for leasing. There would be no summer seismic exploration on the lake, and therefore, no disturbance of terrestrial mammals near the lake due to such activity.

Exploratory Drilling

Under Alternative C, it is projected that the number of exploration and delineation wells drilled (244) would be greater than for Alternative A, B-1 or B-2 and slightly less than in Alternative D. Impacts to terrestrial mammals would be similar to those discussed under Alternative A, but greater in spatial extent, frequency and magnitude than those under the other alternatives, as more exploration would occur. Exploratory drilling would be conducted during the winter when some mammal species are less active or less often present, although wintering Teshekpuk Caribou Herd caribou could be present in large numbers. More exploration activity could occur in the southwestern portion of the NPR-A, so moose, muskoxen, and grizzly bears could experience a greater level of impacts (e.g., disturbance from surface vehicular traffic, humans on foot, fixed-wing aircraft traffic, and the noise of the drill rig itself) than under Alternative A, B-1, or B-2. This assumes their populations' distributions would remain similar over the next 30 years.

The implementation of best management practices and lease stipulations would minimize impacts of exploratory drilling to terrestrial mammals. These best management practices and lease stipulations would include provisions to avoid known grizzly bear dens by one-half mile, methods to avoid attracting wildlife to food and garbage, provisions to protect streambanks from damage during overland moves, provisions to minimize the effect of low-flying aircraft on wildlife (particularly over caribou winter ranges), and provisions to minimize the disturbance and hindrance of caribou in the Teshekpuk Caribou Herd and Western Arctic Herd Habitat Areas.

Oil and Gas Development

Approximately 76 percent of the NPR-A would be made available for leasing under Alternative C. The only significant block of terrestrial NPR-A that would be unavailable for oil and gas leasing would be the 4.4 million acres along the southern boundary where no economically recoverable oil or gas is expected to occur and where the important caribou (Western Arctic Herd), grizzly bear, wolf and wolverine habitat are found.

The primary effects of oil and gas development on terrestrial mammals would be similar to those outlined under Alternative A, and would result from the construction of facilities such as roads and pipelines; motor vehicle traffic within the oil and gas fields and on connecting roads; foot traffic near facilities and camps; aircraft traffic; crude-oil and fuel spills contaminating tundra, stream, and coastal habitats; and habitat alteration associated with gravel mining and construction. The greatest potential for impacts to caribou would be through disruption of Teshekpuk Caribou Herd and Western Arctic Herd calving areas and interference in the movement of insect-harassed Teshekpuk Caribou Herd, and to a lesser extent, Western Arctic Herd caribou between insect-relief habitat and foraging areas. Impacts would be less for the Western Arctic Herd because most of their insect-relief area is within the area unavailable for leasing. These impacts would be greater under Alternative C than under Alternative A, B-1, or B-2, given the larger development scenario that would create more disturbance and directly affect about 42 percent more acres of habitat under long-term disturbance, as compared to Alternative A and the availability for lease of much of the Utukok River Uplands Special Area. Functional loss of habitat would be greater than the acres under direct disturbance. Wolfe (2000) suggested that when caribou in the Central Arctic Herd avoided areas within 2.5 miles of roads during calving season, the functional habitat loss increased from 2 percent of the calving area (the immediate footprint of roads and gravel pads) to 29 percent.

Impacts to terrestrial mammals would be similar in kind to those discussed under Alternative A, but would be more frequent, greater in extent and possibly longer in duration. A greater number of individual animals would likely be exposed to human activities. Aircraft traffic would more often pass over caribou and other terrestrial mammals during flights, and more habitat would potentially be lost permanently.

Construction of permanent roads within the NPR-A would increase access to the area and could increase public and subsistence hunting of terrestrial mammals if those roads were ever connected to villages or other road systems. Among ungulate species, caribou would be most impacted by increased access for hunting, but other species (moose in particular) may also be impacted, depending on the location of permanent roads. The overall number of animals taken would be unlikely to increase dramatically since most hunting would be for subsistence, but roads could focus hunts in particular portions of the NPR-A. Hunting pressure and harvests have increased for many wildlife species near the Trans-Alaska Pipeline System since its construction, but have not produced adverse population effects (Trans-Alaska Pipeline System Owners 2001). It is unlikely that the more remote roads associated with oil and gas development in the NPR-A would have as great an effect on wildlife populations as occurred along the Trans-Alaska Pipeline System corridor.

Caribou – Although much of the construction associated with oil and gas development would occur primarily during winter, development would bring year-round facilities and activities to caribou range. If a field were developed in the region surrounding Teshekpuk Lake, production pads, pipelines, within-field roads, and other facilities would be located within areas used by the Teshekpuk Caribou Herd caribou for calving, insect relief, migration, and wintering. A field development in the northern section of the NPR-A would also require a connector pipeline to link the oil field with facilities to the east, further affecting the Teshekpuk Lake area and possibly impeding migration movements.

The types of impacts of field development on caribou would be similar to those outlined under Alternative A. The probability that a field would be developed within the calving, insect-relief, migration, and wintering grounds of the Teshekpuk Caribou Herd caribou is essentially the same as under Alternative A, so impacts to Teshekpuk Caribou Herd caribou would be similar under Alternative C. Wilson and Loya (2012) and Wilson (personal communication) suggest through their modeling efforts that the remaining high-quality calving habitat would be 82 percent (95 percent confidence interval: 75 to 87 percent) for Alternative C, similar to Alternative A and significantly less than for Alternative B-1 or B-2. Much of the calving area of the Western Arctic Herd would be available for leasing under Alternative C, as opposed to Alternative A, so impacts on the Western Arctic Herd could be much greater. Overall, the level of impact to either herd would depend on the specific location of any oil or gas field.

Traffic could result in local disturbance and displacement of caribou within one to a few miles of the disturbance. A pipeline linking oil or gas fields in the NPR-A with facilities at the Alpine and Kuparuk River Unit oil fields, or directly to the Trans-Alaska Pipeline System at Pump Station 2, would result in the disturbance and displacement of some caribou during winter construction, due to air traffic and to vehicle traffic along ice roads. It is expected that these disturbances would be short term (but see Alternative A's discussion of potential effects of seismic operations) and occur within about one to a few miles of the pipeline corridor.

Oil and gas development within the NPR-A could introduce for the first time such infrastructure and activities into the winter range of a North Slope caribou herd (Teshekpuk Caribou Herd). Previously, no North Slope caribou herd has been exposed to oil or gas activities year-round. The Teshekpuk Caribou Herd has experienced seismic exploration and activities near villages for many years, and some herd members on the periphery of the range have been exposed to oil field facilities in some years, but there is no evidence as yet of adverse effects other than increased hunting mortality for those animals close to villages. It is not known what population effects might occur if the majority of the herd were to have year-round contact with oil and gas facilities and activities. Despite the current lack of evidence regarding adverse effects from seismic exploration and village contact, negative effects on caribou energy budgets during winter could result from this new situation. Such an effect could be manifested through increased winter mortality itself, or a reduction in calf productivity. The Western Arctic Herd has experienced some interference during migration and insect season from the Red Dog mine haul road, but is "naïve" in terms of interactions with infrastructure during the calving season.

Muskoxen – Muskoxen occur in low densities in the NPR-A. Potential effects of oil and gas development activities include displacement and disturbance of individual animals, direct habitat loss from gravel mining in river floodplains and placement at oil field facilities, and indirect habitat loss through reduced access caused by physical or behavioral barriers created by roads, pipelines, and other facilities. Under Alternative C, impacts to muskoxen would likely be greater than those discussed under Alternative A, due to the larger overall development scenario and to the possibility that development in the southernmost areas available to leasing may overlap with current muskoxen range.

Moose – Moose occur in low densities in the NPR-A during the summer and are concentrated in major drainages at the eastern edge of the NPR-A in the winter. Unless oil or gas fields were to be developed in the eastern portion of the NPR-A along the Colville River, development would be unlikely to have more than a minor impact on moose. Under Alternative C, impacts to moose would be similar to those that would occur under Alternative A, because the probability of a development in the eastern portion of the NPR-A would be the same or similar.

If gravel were mined from the eastern portion of the NPR-A, a temporary displacement and disturbance of moose could occur. Borrow pit operations could destroy or degrade up to 1,941 acres of moose habitat if all gravel borrow operations occurred in the eastern portion of the NPR-A (an unlikely scenario).

Dall Sheep – Dall sheep would not be affected by oil or gas activities under Alternative C because the area along the extreme southern edge of the NPR-A where they may occur would not be available for oil or gas leasing.

Grizzly Bears – Major sources of noise include construction of roads, installation of pipelines, pump or compressor stations, gravel mining, and drilling operations. These activities could disturb grizzly bears within a few miles of the noise sources. Industrial activities and human presence could also cause potentially serious disturbances to denning bears. Under Alternative C, impacts would be greater than those that would occur under Alternative A, because of the larger overall development scenario and the fact that much of the Utukok River Uplands Special Area would be available for leasing. Grizzly bears are present in low numbers in the northern portion of the NPR-A, but may be attracted to development activities. It is likely that the greatest number of bears would be encountered during development in the southwestern portion of the NPR-A that would be available for leasing under Alternative C, since the greatest bear density occurs in this area.

Wolves – Under Alternative C, oil and gas development would have a greater impact on wolves than under Alternative A. Potential effects on wolves would include short-term disturbance from air and surface traffic and human presence, and increased hunting and trapping pressure through improved access or increased human presence associated with oil or gas development. If caribou abundance decreased substantially as a result of oil and gas development, wolf abundance could also decrease. Wolves are generally not abundant in the northern portions of the NPR-A, but achieve higher densities along the Colville River and especially in the southwestern portion of the NPR-A that would be available for leasing under Alternative C.

Wolverines – Similar to the other alternatives, under Alternative C, some wolverines could be displaced in the vicinity of oil or gas field facilities. Impacts under this alternative are likely to be greater than those that would occur under Alternative A, given the larger overall amount and extent of potential development in the NPR-A and because wolverines are thought to be at their highest densities in the southwestern portion of the NPR-A that would be available for leasing under Alternative C.

Foxes – Under Alternative C, impacts to arctic and red foxes would be similar to those discussed under Alternative A, although they would likely be greater in spatial extent due to the greater development scenario. An increase in the fox population associated with oil or gas development could affect some prey species of foxes (such as ground-nesting birds and molting waterfowl) in the development area and over a region larger than the oil field itself (Burgess et al. 1993).

Effects of Abandonment and Reclamation

Abandonment and reclamation activities are expected to disturb and displace terrestrial mammals in a manner similar to that associated with construction. The intensity of the disturbance might be less than during construction, however, because it is possible that caribou, muskoxen, and other terrestrial mammals would have become habituated to road and air traffic over the course of construction and operation of the facilities. Some individuals could be killed by collisions with road traffic. If roads were left in place and maintained in useable condition upon abandonment, they could continue to provide improved access to hunting areas, with consequent hunting pressure on caribou and other subsistence species. Revegetation of roads, pads, and airstrips, if left in place, would facilitate reclamation of habitat, but plant communities on these raised gravel structures would likely be different from those that prevail in adjacent areas and may include invasive species. Pads, roads, and airstrips could provide some insect-relief habitat for caribou, if left in place (Murphy and Lawhead 2000). If gravel fill was removed and the pad revegetated with vegetation similar to the surrounding plant communities, caribou, and possibly other terrestrial mammals, would use the area. Foam insulating materials that could be used in pad construction could be broken up in the course of removal. If some of this foam escapes being cleaned up, it may be used by foxes as denning material. Depending on the material's toxicity and the amount ingested by a fox, this could cause mortality, though the numbers of foxes killed would likely be very small. Overall, a greater amount of development is assumed under Alternative C than under Alternatives A, B-1, or B-2, providing a potential of greater impacts from abandonment and reclamation. Those impacts would likely be expressed over a similar time period, but result in no population-level effects from these activities in any case.

Effects of Spills and Gas Releases

Spills could involve crude oil, refined products, produced water, or seawater. Typical refined products that are spilled on the Alaska North Slope include aviation fuel, diesel fuel, engine oil, fuel oil, gasoline, grease, hydraulic oil, transformer oil, and transmission oil. The extent of environmental impacts would depend upon the type, location, and amount of materials spilled or released, and the effectiveness of the response. The majority of small spills would be contained on the gravel pad and would have no impact on terrestrial mammals or their habitat. Gas releases could occur at well sites (i.e., over a gravel or ice pad) or from pipelines, the great majority of which would be over tundra.

The impacts of oil spills and gas releases on terrestrial mammals are described under Alternative A (section 4.3.9 in Volume 2, “Terrestrial Mammals”). Compared to Alternative A, the risk of oil spills is slightly less under Alternative C. A total of one large spill is still assumed. The number of small spills assumed for Alternative C is nearly identical to Alternative A: 98 percent as many for both crude and refined oil spill. Assumed spill volume is also slightly less at 98 percent of Alternative A. Activities occurring in the vicinity of Teshekpuk Lake could increase the likelihood that a spill would reach the lake under Alternative C. Because most spills would be small and affect a small area, the majority of impacts to terrestrial mammals would likely result from disturbance associated with spill cleanup activities, rather than from direct oiling.

The assumed number of gas releases (6.2 incidents = 0.9 incidents per 300 pipe miles times 2,077 miles of pipe), if ignited, would result in thermal effects to approximately 1,203 acres of tundra. If a wildfire resulted, additional acreage would burn, the amount depending on season, weather conditions, moisture content of vegetation, and suppression effort.

4.6.9.3 Effectiveness of Stipulations and Best Management Practices

The lease stipulations and best management practices developed to protect terrestrial mammals under Alternative C are largely equivalent to the stipulations and required operating procedures designed to do the same under Alternative A. As such, they will provide the same benefits. Notable exceptions to this are an addition to Best Management Practice E-8 to encourage storage and reuse of overburden and sod at material sites or other disturbed sites; the addition of Best Management Practice E-20 to aid in monitoring and assessing wildlife movements during and after construction of infrastructure; an addition to Best Management Practice F-1 and the addition of stipulation K-12 to extend the flight restrictions and other protections covering the Teshekpuk Lake Caribou Habitat area to the Utukok Uplands Special Area; improved control of ground traffic in Stipulation K-5; a setback of 1 mile rather than three-quarters of a mile along the Kogru River in Lease Stipulation K-6; and a slight increase to the size of the Caribou Movement Corridors in Lease Stipulation K-9.

4.6.9.4 Conclusion

Under Alternative C, impacts to terrestrial mammals would be similar in type to those discussed under Alternatives A, B-1 and B-2, but would be greater in frequency and extent because of the potential for greater oil and gas development to occur, including in areas currently unavailable for leasing, and thus, off limits to surface-development activities. There would be an increase in the likelihood of impacts to caribou calving areas and migration routes leading to insect-relief habitat, as well as an increased likelihood of development occurring within calving and insect-relief habitat.

It is expected that under Alternative C, impacts to terrestrial mammals in the vicinity of Teshekpuk Lake would be similar to those under Alternative A, and greater than those under Alternatives B-1 and B-2, particularly with respect to caribou calving and insect-relief habitat. Impacts would be greater (compared to nearly zero) in most of the Utukok River Uplands Special Area, suggesting much greater impacts to Western Arctic Herd caribou, bears, wolves, wolverine, and potentially muskoxen. Overall, impacts throughout the NPR-A would be greater under Alternative C than under Alternative Alternatives A, B-1 or B-2, given the greater overall scale of the assumed development activities. In general, impacts to mammals from non-oil and gas activities, and from oil and gas activities, would likely be additive, as opposed to compensatory, except possibly in those areas where both types of activities occurred simultaneously. Impacts to mammals from exploration and development activities would also be additive, except possibly for habitat impacts where development occurred in habitats previously disturbed during exploration. In areas where two or more activities occurred, overall impacts would reflect those impacts associated with the first activity and any new impacts associated with later activities. Based on the amount of habitat with a potential to be directly affected by actual development footprint, impacts to mammals under this alternative would be about 55 percent greater than Alternative A. If oil and gas activities occurred in areas with an abundance of caribou or other mammals, or in areas with high-quality habitat, impacts could be greater than those based strictly on number of acres of habitat impacted due to disturbance effects.

There will be impacts to terrestrial mammals from climate change (section 3.3.6.8 in Volume 1) and from the oil and gas activities expected under Alternative C. Whether the combination of impacts from these two sources is additive or compensatory, or synergistic or countervailing, will depend on where and how development and climate change actually play out in the NPR-A. Climate change could make foraging more difficult on herbivores during winter, possibly causing negative, synergistic effects to mammals, when combined with disturbance and displacement of mammals by oil and gas activities. Geographic shifts in the vegetation communities of the NPR-A, as a result of climate change could have synergistic impacts to mammals if they resulted in a greater proportion of higher quality habitat for any season overlapping with areas of concentrated oil and gas activity. Alternatively, these vegetation community shifts could move important habitat out of the areas affected by oil and gas activity, resulting in a countervailing effect. Climate change may increase the availability of suitable habitat for some species (e.g., shrub habitat for moose), but may reduce suitable habitat for other species. For any terrestrial mammals affected in the latter way, it is likely that adverse impacts of climate change will be additive to any adverse effects of oil and gas activities, and the two combined may have synergistic adverse effects.

4.6.9.5 Potential New Mitigation Measures

Potential Mitigation Measure 1 – Hazing by aircraft (new subparagraph to Best Management Practice F-1)

The objective and requirement/standard would be the same as those described in section 4.3.9.5 for Potential Mitigation Measure 1 – Hazing by aircraft. The potential benefits and residual/unavoidable impacts would be similar to those described for Alternative A at section 4.3.9.5 in Volume 2.

Potential Mitigation Measure 2 – Chasing wildlife with ground vehicles (new best management practice)

The objective and requirement/standard would be the same as those described in section 4.3.9.5 for Potential Mitigation Measure 2 – Chasing wildlife with ground vehicles. The potential benefits and residual/unavoidable impacts would be similar to those described for Alternative A at section 4.3.9.5 in Volume 2.

4.6.10 Marine Mammals

4.6.10.1 Activities Not Associated with Oil and Gas Exploration and Development

Baleen Whales

Effects of activities not associated with oil and gas exploration and development on gray and minke whales would be similar to the other alternatives.

Toothed Whales

As with Alternatives A, B-1, and B-2, the impacts of activities within the NPR-A, but not related to oil and gas exploration and development, would include air traffic; aerial surveys to inventory wildlife or other resources; summer research camps; hazardous material or debris removal; and recreational camps and boating activity. The effects of Alternative C on beluga whales, narwhals, harbor porpoises, and killer whales would be similar to Alternatives A, B-1, and B-2.

Ice Seals

Aircraft and water traffic are the non-oil and gas activities most likely to have a direct impact on spotted and ribbon seals. The potential effects of these activities are described under Alternative A. Impacts from activities not associated with oil and gas exploration and development would not differ from those described under Alternatives A, B-1, and B-2. Impacts from non-oil and gas-related activities would be negligible.

4.6.10.2 Oil and Gas Exploration and Development Activities

Baleen Whales

The types of effects to gray and minke whales from oil and gas exploration under Alternative C would be similar to the other alternatives, although the likelihood and magnitude of potential effects may differ. Oil and gas exploration and development activities under Alternative C could be higher than in Alternatives A, B-1, and B-2 because of the increased acreage available for leasing. This could result in more barging of equipment and infrastructure, and increased marine noise. Similar to Alternative B-1, all major coastal waterbodies and adjacent islands, which includes Kasegaluk Lagoon, Peard Bay, and Elson Lagoon/Dease Inlet/Admiralty Bay would be unavailable for leasing under Alternative C. No non-subsistence permanent infrastructure would be allowed except for buried pipelines under Wainwright Inlet/Kuk River, and no oil and gas exploration would be allowed between May 15 and October 15. Although the proposed acreage of the Peard Bay and Kasegaluk Lagoon Special Areas is less than under Alternative B-1, it is the same as under Alternative B-2 and would reduce impacts to baleen whales more so than under Alternatives A and D. There could be more impacts to the relatively small number of gray whales that venture east of Barrow than under Alternatives B-1 or B-2 because coastal areas east of Barrow could be leased under Alternative C.

Seismic Activities

Effects from onshore seismic surveys would be similar to Alternative A and not expected to affect cetaceans. The unavailability of oil and gas leasing in the Peard Bay Special Area and in Elson Lagoon/Dease Inlet/Admiralty Bay, and Wainwright Inlet/Kuk River may reduce any noise from seismic testing to enter these marine waters compared to Alternative A.

Shipping

Effects from shipping under Alternative C may be similar to the other alternatives and possibly scale with the acreage leased. The protected marine areas (Peard Bay Special Area and Kasegaluk Lagoon Special Area) could result in fewer nearshore barge transits in those areas and less noise produced in adjacent marine waters compared to Alternatives A and D, although large whales are not known to use these Special Areas. However, it seems likely the Barrow, Cape Simpson and the Lonely region would be used as staging areas, and some effects from shipping may occur. However, since minke whales are not known to occur in the Beaufort Sea and gray whales are restricted mainly to the waters west of Cape Simpson, nearly all interactions would occur along the NPR-A Chukchi Coast. Ship/whale collisions are expected to be relatively rare.

Toothed Whales

Oil and gas exploration, development, and transport activities within the NPR-A could impact beluga whales, harbor porpoises, narwhals, and killer whales in a manner similar to Alternatives A, B-1, and B-2. Those would include disturbance from anthropogenic sounds, ship strikes, or habitat degradation. Sound would be produced by vessels and aircraft, seismic operations, construction of facilities close to the coast, or exploration, production and transport of oil or gas. Vessels supporting activities in the NPR-A could strike whales or porpoises causing injury or death.

Activities under Alternative C might be slightly higher than in Alternatives A, B-1, and B-2 because there are more acres available for leasing. If more leases means more oil and gas activity as described in section 4.2.1.2 in Volume 2, there might be an increase in aircraft use within the NPR-A, and more barge activity to transport exploration or development equipment to the NPR-A. If this occurs, more individual animals may be exposed to more anthropogenic sounds, increasing the possibility of deflection from preferred areas.

Increased barging would also increase the possibility of marine mammals being struck by a vessel.

However, under Alternative C, leasing of all major coastal waterbodies and adjacent islands, which includes Kasegaluk Lagoon and Peard Bay Special Areas and Elson Lagoon/Dease Inlet/Admiralty Bay, are unavailable for leasing as under Alternatives B-1 and B-2. No non-subsistence permanent infrastructure would be allowed except for buried pipelines under Wainwright Inlet/Kuk River, and no oil and gas exploration would be allowed between May 15 and October 15. These provisions would reduce impacts to toothed whales in Alternatives B-1 and C, compared to Alternatives A and D, because activities would not be permitted near many coastal areas and possible aggregation areas.

Impacts from oil and gas activities in Alternative C might be slightly higher than Alternatives B-1 and B-2 because of the increased acreage available for leasing (assuming the amount of available leases correlates to the amount of exploration and development), but would still likely be minimal and less than impacts from activities specified in Alternatives A and D.

Ice Seals

Potential types of direct and indirect effects on spotted and ribbon seals from activities authorized under Alternative C do not differ from those described under Alternative A. Oil and gas-related effects, however, would likely be more limited than those disclosed under Alternative A, but slightly increased relative to Alternatives B-1 and B-2. Alternative C does not allow leasing or oil and gas-related development in Elson Lagoon, Dease Inlet, Admiralty Bay, Wainwright Inlet/Kuk River, Peard Bay, and Kasegaluk Lagoon, the associated islands, and lands within 1 mile of Peard Bay and Kasegaluk Lagoon (Map 3-2). This is more named waterbodies than under Alternatives A and D. Unavailability would preclude the possibility of production oil spills directly into these important marine waters, and would protect spotted and ribbon seals from most other direct impacts as well (including facility-related disturbance at spotted seal haulouts). The chance for an onshore spill to reach marine waters would also be more effectively minimized under this alternative relative to Alternative A due to the inclusion of twice as many rivers with setbacks in the K-1 Stipulation, and more coastal areas included in development restrictions of Stipulation K-6. Both species would still be at risk of refined oil spills and discharge in marine waters related to shipping traffic in support of onshore activities. Spotted seals may also be affected by aircraft flights and marine traffic near terrestrial haulouts the same as in Alternative A.

4.6.10.3 Effectiveness of Stipulations and Best Management Practices

Baleen Whales

The effectiveness of stipulations and best management practices would be similar to that of the stipulations and required operating procedures in Alternative A, although Stipulation K-3 would offer greater protection by including more coastal waterbodies.

Toothed Whales

Best management practices, as they relate to beluga whales, narwhals, harbor porpoises, and killer whales for Alternative C are the same as Alternatives B-1 and B-2 and similar to the required operating procedures and stipulations in Alternative A. Effectiveness of the best management practices for protecting marine mammals is expected to be better than the required operating procedures. Best management practices under Alternatives B-1, B-2, and C include more protections for Peard Bay, Wainwright Inlet/Kuk River, and Kasegaluk Lagoon than required operating procedures under Alternative A.

Ice Seals

The stipulations and best management practices of Alternative C, as they relate to ice seals, are similar to the required operating procedures and stipulations in Alternative A. Notable exceptions are Stipulations K1, K-3b, K-6 K-8b, and Best Management Practice C-1. In Alternative C, Stipulation K1 would more effectively minimize the chance that an onshore oil spill would reach marine waters by including twice as many rivers as what are named in Alternative A (i.e., Alternative C uses the same list as Alternatives B-1, B-2, and D). Stipulation K-3b protects more major coastal waterbodies than Alternative A, but one fewer than Alternatives B-1 and B-2 (i.e., the Kogru River is excluded). Stipulation K-8b extends the no permanent development restriction of Kasegaluk Lagoon to 1 mile inland from the lagoon. The areas covered by Stipulations K-3b and K-8b would be unavailable for leasing, and therefore, under this alternative would be a best management practice with applicability only to off-lease activities. Best Management Practice C-1 is made more effective in this alternative than in Alternative A, due to the explicit requirement for operators to conduct a survey to detect (and then avoid) seal birthing lairs for activities during the seal pupping season (through April 15). Stipulations and provisions for marine areas made unavailable for leasing are expected to be effective at minimizing impacts to ice seals within these areas. In addition, seals would be adequately protected within Special Areas, such as Kasegaluk Lagoon and Peard Bay where marine mammals are specifically listed as a main value to protect. As with all other alternatives, discharge from support vessels may not be effectively regulated through the A-series required operating procedures, and could result in impacts to both species.

4.6.10.4 Conclusion

Baleen Whales

Under Alternative C, most impacts remain associated with marine shipping and barging. Most of the impacts are disturbances related to marine noise, but ship/whale collisions are a possibility. As with Alternatives A, B-1, and B-2, population-level effects are unlikely.

Toothed Whales

Potential impacts from non-oil and gas activities will be the same under Alternatives A, B-1, B-2, and C. Impacts to belugas, narwhals, harbor porpoises, and killer whales from oil and gas activities under Alternative C might be slightly higher than Alternatives B-1 and B-2, because of the increased acreage being offered for lease, but would likely still be short-term and less than Alternative A. The most likely impact to belugas, in particular, would be displacement from preferred habitats or disturbance to normal behavior due to anthropogenic sounds. These impacts would likely be localized and temporary and population-level effects are unlikely.

Ice Seals

Under Alternative C, the most likely effect to spotted seals from non-oil and gas-related activities would be in the form of haulout disturbance by aircraft and marine vessels. Effects from this source would likely be short term and of the same magnitude as presented in Alternative A. Ribbon seals are unlikely to be affected by non-oil and gas activities due to their pelagic nature. Types of impacts to spotted seals from oil and gas activities will be similar to non-oil and gas activities (i.e., haulout disturbances), but will also include the chance of an accidental large or very large contaminant spill, potential decrease in prey availability if nearshore and riverine fish species are impacted, and a higher potential for the introduction of pathogens from increased marine vessel traffic. Relative to Alternative A, the potential for impacts from oil and gas activities is greatly decreased due to an increase in special areas and lands made unavailable for leasing, and changes in Stipulations K1, K-3b, K-6, and K-8b, and Best Management Practice C-1. However, the potential for impacts are slightly greater than in Alternatives B-1 or B-2. These impacts cannot be accurately predicted, but could potentially cause behavioral and some physiological responses large numbers of spotted seals. Due to their absence from the nearshore area, ribbon seals are only likely to experience adverse effects from large contaminant spills that are not effectively cleaned up before drifting out to sea, or the introduction of new pathogens to the system. Alternative C would more effectively protect ribbon and spotted seals against development pressures than Alternative A, but would provide less protection than Alternatives B-1 or B-2, as the area set aside as special use and unavailable areas is smaller in scope. Development in the NPR-A planning area could negatively impact spotted seals within or adjacent to specific haulout areas but is only likely to have minimal effects on ribbon seals.

Climate change effects, such as sea-ice loss, could affect the susceptibility of ice seals to impacts from development. How these species react to changes in sea-ice conditions is unknown at this time. Spotted seals have the capacity to adapt by using other haulout substrates such as terrestrial areas. Such a change however, would put them at greater risk from both non-oil and oil and gas activity disturbance onshore. Ribbon seals, a pelagic ice-dependent species may be less vulnerable to the combined effects of sea-ice changes and oil and gas development activities. The mechanisms by which effects of climate change and anthropogenic activities interact are unknown and could range from synergistic to countervailing.

4.6.10.5 Potential New Mitigation Measures

Potential Mitigation Measure 1-- Aircraft Avoidance of Seal Aggregations (Addition to F-1 Best Management Practice)

The objective and requirement/standard would be the same as those described in section 4.3.10.5 in Volume 2 for Potential Mitigation Measure 1— Aircraft Avoidance of Seal Aggregations. The potential benefits and residual/unavoidable impacts would be similar to those described for Alternative A at section 4.3.11.5 in Volume 2.

Potential Mitigation Measure 2—Marine Vessel Avoidance of Terrestrial Aggregations of Seals (Addition to K-6 Stipulation - Coastal Area)

The objective and requirement/standard would be the same as those described in section 4.3.10.5 in Volume 2 for Potential Mitigation Measure 2— Marine Vessel Avoidance of Terrestrial Aggregations of Seals. The potential benefits and residual/unavoidable impacts would be similar to those described for Alternative A at section 4.3.11.5 in Volume 2.

4.6.11 Special Status Species

The following discussion of impacts is divided into four sections that discuss special status species of plants, birds, terrestrial mammals, and marine mammals.

Within each subsection, authors describe impacts of non-oil and gas activities and oil and gas activities and the effectiveness of stipulations and required operating procedures and then provide a conclusion (where the discussion is long enough to warrant one). All potential new mitigation measures for special status species are discussed at section 4.3.11.5 in Volume 2.

4.6.11.1 Special Status Species of Plants

Nine plant species listed as BLM Sensitive Species and their habitats are described in section 3.3.8 in Volume 1. All of these have been found within the outer boundaries of the NPR-A. An additional 12 species designated as sensitive by BLM-Alaska have been documented on the North Slope, but have not yet been documented in the NPR-A. The types of impacts to these plant species are the same as those for all other vegetation. These impacts are described in section 4.6.5 and are not repeated here.

Under Alternative C, development would be unlikely to affect any plant species' existence or any plant communities at scales larger than local effects. However, if development facilities were constructed in an area containing a population of a BLM Sensitive plant species (by definition rare), the impacts to that population, and thus, the species could be severe. Some of the habitats potentially occupied by sensitive species would be protected from development under Alternative C by setbacks along rivers and lakes. Other species occur in dry habitats associated with bluffs, floodplains, river terraces, sand dunes, rocky outcrops, and fellfields. These habitats are the primary sources of gravel fill used during construction and development (National Research Council 2003) and could be impacted by development in these areas.

4.6.11.2 Special Status Species of Birds

This section discusses the potential direct and indirect effects to threatened, endangered, and sensitive bird species that could result from management actions in the NPR-A under Alternative C. This includes yellow-billed loon, spectacled eider, Steller's eider, Kittlitz's murrelet, red knot, short-eared owl, and golden eagle (collectively referred to as special status species below). All of these species are migratory and do not occur in the NPR-A during winter.

Most of the activities that could potentially affect these special status birds in the NPR-A would result from oil and gas exploration, development and transport.

Other activities that could potentially affect birds include permitted recreation, guided hunting, activities associated with scientific surveys and research camps, cleanup of oil and gas exploration sites, and activities associated with government actions (e.g., cleanup of abandoned well sites). These activities could affect tundra-nesting special status birds by causing: (1) habitat loss; (2) disturbance or displacement; (3) increased predation; and (4) direct mortality. Impacts would most often be localized and on the scale of individual birds.

Alternative C would make available approximately 76 percent (17.9 million acres) of the NPR-A for oil and gas leasing, although leasing in lands currently deferred from leasing (see Alternative A) would not be offered for lease pending expiration of the deferrals (Map 2-3). Approximately 4.4 million acres in the far south of the planning area, Kasegaluk Lagoon Special Area, and the major coastal waterbodies of Elson Lagoon, Dease Inlet, Admiralty Bay, and Wainwright Inlet/Kuk River would be unavailable for leasing and a new Special Area (Peard Bay Special Area) would be created. Management practices would emphasize performance-based stipulations and best management practices on surface activities, consultation with local residents, and coordinated scientific studies to protect wildlife habitat, subsistence use areas, and other resources.

Activities Not Associated with Oil and Gas Exploration and Development

Under Alternative C, activities not related to oil and gas exploration and development that could affect special status species in the NPR-A would be the same as those described under Alternative A: air traffic; aerial surveys to inventory wildlife or other resources; summer research activities; hazardous material or debris evaluation and presence and removal; and permitted recreational camps and boating activity. As compared to Alternative A, impacts to eiders from non-oil and gas activities could be less frequent, lesser in extent, or shorter in duration under Alternative C. Fewer individual animals likely would be exposed to human activities. This is because new non-subsistence infrastructure would be prohibited from large areas important to some special status species and because the lesser amount of oil and gas activity projected in this alternative may reduce the amount of non-oil and gas activity by reducing the impetus for scientific studies. Aircraft traffic would less often pass overhead of special status species during flights to or from the camps and along aerial survey routes. Impacts would generally be localized, and the disturbance reactions of special status species would likely be brief. Some special status species might avoid scientific and recreation camps during the 6 to 12 weeks of activities, while their predators (e.g., ravens) could be attracted to the camps. Best management practices and large areas in which new non-subsistence permanent infrastructure is prohibited protect birds and their habitats and would help to mitigate the potential effects of non-oil and gas activities on special status species under Alternative C.

Oil and Gas Exploration and Development Activities

Exploration

Ground-based seismic surveys to collect geological data and exploration activities occur during the winter months when special status species are absent from the NPR-A. Therefore, these activities would likely have no direct impacts on these species. Fourteen seismic surveys are estimated to take place under Alternative C. Under Alternative C, the indirect impacts to eiders associated with winter exploration would be greater than those under Alternatives A, B-1, and B-2, as more areas of high value to eiders would be available for exploration. The use of air guns for boat-based seismic work would not be allowed in several large coastal bays and lagoons because of restrictions in Stipulation K-3b (Dease Inlet, Admiralty Bay, Elson Lagoon, Peard Bay, Wainwright Inlet/Kuk River, Kasegaluk Lagoon, and their associated islands). This is a larger total area protecting birds from air gun disturbance than provided under Alternative A.

Alternative C prohibits exploration activities in the same areas and manner as Alternative A (i.e., in Dease Inlet, Admiralty Bay, Elson Lagoon, and associated islands). However, unlike Alternative A, it adds other high-quality bird habitats to the prohibition. These include Peard Bay, Kasegaluk Lagoon, and Wainwright Inlet/Kuk River. These areas are very important to many special status species during critical life stages such as migration staging, molting, and breeding, and therefore, special status species would benefit greatly from the protection. During winter, when exploration activities would be allowed (but no special status species are present), indirect impacts could result from the construction of ice roads and ice pads, and the associated water withdrawal. The types of effects that could result from the construction and use of ice roads and ice pads would be the same under Alternative C as those described under Alternative A, and would primarily involve the temporary alteration of tundra habitats. Water withdrawal for ice road construction could also temporarily alter habitats adjacent to water source lakes, which could affect nesting or brood-rearing loons and eiders. Approximately 25 percent more area would be available to oil and gas exploration activities under Alternative C, as compared to Alternative A. Therefore, the potential impacts to birds resulting from exploratory activities would likely be greater under Alternative C than under Alternative A, and would be even higher relative to Alternatives B-1 and B-2.

Alternative C contains the same measures as all other alternatives to avoid human-caused increases in predator populations. This includes Required Operating Procedure/Best Management Practice A-2 and Stipulation E-9, which would minimize the availability of anthropogenic food (e.g., garbage) and shelter, respectively that could be utilized by predators. Similarly, measures addressing proper handling of hazardous materials associated with the drilling process and accidental spills are the same among all alternatives as well (i.e., Required Operating Procedures/Best Management Practices A-1 through A-7). Therefore, Alternative C offers no advantage or disadvantage to special status birds from the handling of waste products. Under Alternative C, moderate effects to spectacled eiders could occur in the goose molting area, the entire area of which would be unavailable for oil and gas leasing under Alternative A. Under Alternative C, oil and gas exploration wells would create an estimated combined short-term ground disturbance of 744 acres, and a long-term ground disturbance of less than 1 acre. Delineation wells would impact the same number of acres, although not necessarily in the same locations as the exploration wells. This amount of short-term habitat loss is approximately 20 percent greater than what is predicted for Alternative A. There is essentially no long-term habitat loss predicted from exploration activities in any alternative.

Development and Production

Under Alternative C, these types of development and production activities would be the same as those discussed under Alternative A. In order to mitigate the potential negative effects of activities associated with the oil and gas development and production activities Alternative C includes Stipulations E-2, G-1, K-2, K-3a and b, K-4a, K-6, K-9, K-10 and K-11. Stipulations K-4a and K-6 in Alternative C offer greater protection to birds than do the corresponding stipulations in Alternative A. However, because the amount and location of activities could be different under Alternative C, effects to the special status birds could also vary as discussed in detail below.

Habitat Loss. Of all activities, gravel mining and placement for the construction of oil and gas field infrastructure would have the greatest potential to result in the permanent loss of habitat for short-eared owl, yellow-billed loon, and spectacled and Steller's eiders. Under Alternative C, it is estimated that a total of 860 acres would be disturbed for oil central processing facilities and gas compressor facilities (see Table 4-14 in Volume 2). In conjunction with these facilities, other support structures would also be needed, such as gravel production pads, runways, and roads. Under Alternative C, the gravel footprint (total long-term disturbance) of these production facilities would be 15,721 acres (see Table 4-14 in Volume 2). Alternative C is predicted to create a greater amount of long-term surface disturbance than Alternative A.

In addition to permanent habitat loss, temporary loss of tundra habitat adjacent to gravel roads and pads could occur as a result of thermokarst, dust deposition, snow accumulation, water withdrawals (if recharge does not occur) and impoundment formation. Under Alternative C, the types of effects to special status species resulting from temporary habitat loss would be the same as those discussed under Alternative A. However, the potential for temporary loss would likely be greater under Alternative C than under Alternative A, due to the greater amount land available for leasing, likely resulting in an increased need for pads, pipelines, roads, and associated infrastructure. The extent of effects to special status species from temporary habitat loss would depend on the number of individuals occurring in areas within and adjacent to the development.

Mortality to special status species could result from collisions with vehicles (ground and air), structures such as elevated pipelines, buildings, drilling rigs, towers, power lines if suspended, boats (including barges), or bridges. Any species of bird may be vulnerable to collision under certain circumstances (see Alternative A); in fact, it is one of the few ways that golden eagle, short-eared owl, Kittlitz's murrelet, or red knot could potentially be impacted under any alternative. Under Alternative C, the types of effects to birds resulting from collisions with structures would be the same as those discussed under Alternative A, although the potential for collisions would be greater under Alternative C than under Alternative A, due to the greater amount land available for leasing, likely resulting in an increased need for pads, pipelines, roads, and associated infrastructure. However, mortality from collisions would be minor under any alternative. All of the special status species would likely be impacted at the level of the individual and not at a population level.

Disturbance. The potential for disturbance to special status species from ground-based travel on roads, within pads, and cross-tundra would likely be greater under Alternative C than under Alternative A. After the expiration of the 2018 deferral Alternative C would provide about 20 percent more lands available for oil and gas leasing (including a large tract of important bird habitat east of Dease Inlet and around Teshekpuk Lake), resulting in an increased need for pads, pipelines, roads, and associated infrastructure, resulting in an increased need for pads, pipelines, roads, and associated infrastructure. Potential impacts from summer cross-country travel on tundra would be limited in Alternative C, the same as all other alternatives, and would only be allowed on a case-by-case basis, and only after extensive studies have been conducted (Required Operating Procedure/Best Management Practice L-1).

Aircraft, both fixed-wing and helicopter, would provide access for oil and gas-related activities throughout the development, operation, and abandonment of any oil or gas field developed in the NPR-A. The types of disturbance effects to special status species from aircraft would be the same under Alternative C as those discussed under Alternative A, and could include displacement from preferred feeding habitats, temporary or permanent nest abandonment, and temporary or permanent displacement from staging, molting, or brood-rearing areas. Aircraft disturbance effects would be lowest in Alternatives B-1 and B-2, third in Alternative A, with greater levels of disturbance likely to occur in Alternative C, and the highest level likely to occur in Alternative D.

The types of disturbance effects to special status species from watercraft would be the same under Alternative C as those discussed under Alternative A, and could include displacement from preferred habitats and nest abandonment. As the expected number of sealifts in Alternative C would be higher than in Alternative A, the impacts from bird collisions with barges would also be higher in Alternative C.

Oil-spill-response training activities using watercraft could be conducted on rivers and lakes several times during the open-water season. The potential for disturbance to some special status species from these activities would likely be greater under Alternative C than under Alternative A, due to the greater amount land available for leasing, likely resulting in an increased need for pads, pipelines, roads, and associated infrastructure. The extent of effects to special status species from oil spill and gas release response activities would depend on the species and numbers of individuals occurring in areas within and adjacent to the impacted area.

Predation. Some predators, such as ravens, gulls, arctic foxes, and bears could be attracted to areas of human activity where anthropogenic sources of food and denning or nesting sites were present. The potential impacts of increased numbers of predators on eiders are discussed under Alternative A. Increased predation pressure could have moderate impacts on any of the special status species. Under Alternative C, there would be greater potential for bird mortality due to predation than under Alternative A, as there would be more human activity and anthropogenic sources of food available.

Abandonment and Reclamation

Development scenarios indicate that at abandonment of the field, gravel pads and roads may or may not be removed, and that reclaimed or abandoned pads may be revegetated by native vegetation or would be allowed to bed naturally. Given that scenario, it is very difficult to determine potential effects to special status species from these unknown activities. For this document, it is assumed that all gravel will be removed after abandonment. Given that assumption, the impacts of abandonment and reclamation of oil and gas fields on birds would be similar in many respects to those incurred by construction activity. The types of impacts would be the same for Alternative C as described in Alternative A. Impacts would likely be greater for Alternative C than for Alternative A, as more area would be available for oil and gas development in Alternative C, resulting in a greater total area to be abandoned and subsequently reclaimed.

Oil Spills and Gas Releases

Under Alternative C, the types and levels of effects to special status species from oil and seawater spills and gas releases would be the same as those discussed under Alternative A.

Although the estimated large spill volume is the same for all alternatives, the probability of a spill occurring varies little between Alternatives A, C, and D (37, 37, and 39 percent chance of a large spill, respectively), while Alternatives B-1 and B-2 are estimated to have a 28 and percent chance, respectively, of a large spill. Even with the protection of particularly sensitive areas (e.g., coastal shoreline and goose molting area), and the substantial emphasis on spill prevention and response, if a large crude oil spill occurred it could have a measurable effect on some special status species at a population level. Exceptions to this would be the species whose range only peripherally includes the NPR-A or adjacent marine waters, such as golden eagle, red knot, and Kittlitz's murrelets, or those not associated with water (e.g., golden eagle and short-eared owl). Effects to individual birds that make contact with oil or oiled forage could range from short-term disturbance to death. This applies to all of the special status species regardless of how uncommon they are; in fact, this is one of the few ways that red knot, Kittlitz's murrelet, or golden eagle could potentially be impacted by any alternative. Impacts to special status species (especially yellow-billed loon and eiders) on a population level could occur if oil from a large spill entered rivers, important molting or brood-rearing lakes, or marine areas during periods when large proportions of those species are present. Many factors would determine the probability and extent to which birds would be negatively impacted by a large oil spill, including the quantity spilled, season, location (e.g., land versus water), and proximity to sensitive habitat. Although the probability of a spill varies by alternative, the impacts to individual birds from large crude or refined oil spills would be the same as under all alternatives if a spill was to occur in a location where birds were present.

Oil entering a river or stream could potentially spread into delta or coastal areas, where impacts could be more severe to staging or molting yellow-billed loons and spectacled or Steller's eiders. An oil spill in coastal zone and nearshore habitats of the Colville River Delta, Harrison Bay, Smith Bay, Dease Inlet, Elson Lagoon, or Kasegaluk Lagoon, which support large congregations of threatened eider species, could affect large numbers of individual birds. Under all alternatives, the potential that an oil spill would enter a major river or stream would be minimized by Stipulation K-1. This would provide setbacks from specified rivers, within which permanent oil and gas facilities would be prohibited, although pipelines may be allowed in some of these areas. The greater need for marine transportation under Alternative C relative to Alternative A would increase the opportunity for a spill to occur. For further discussion of potential effects of marine spills, see Alternative A.

A gas release from a well is expected to last one day and to release 10 thousand cubic feet of gas while a release from a transmission pipeline or processing facility is estimated to release 20 thousand cubic feet over a few hours. Although the estimated release volume is the same for all alternatives, the difference in the estimated number of gas production wells and lengths of various pipelines would change the probability of a release between the alternatives. The potential for disturbance to birds from a gas release would likely be greater under Alternative C, as compared to Alternative A, due to the greater amount land available for leasing, likely resulting in an increased need for pads, pipelines, roads, and associated infrastructure, and the protections imposed on some areas that may contain large numbers of special status species.

Effectiveness of Stipulations and Best Management Practices

Alternative C makes 75 percent of the NPR-A available for oil and gas leasing while providing unavailable areas, the creation of a new Special Area (Peard Bay), and retention of the other existing Special Areas, recommendation to Congress that three rivers be designated for inclusion in the Wild and Scenic Rivers System as Scenic, and numerous surface protections. The unavailable land and designated Special Areas result in the protection of many natural resources including birds and bird habitat.

Alternative C would make approximately 4.4 million acres unavailable for leasing in the Utukok River Uplands Special Area. Lands north and northeast of Teshekpuk Lake would be protected through 2018 due to the deferral currently in effect. Other lands would be unavailable for leasing in Alternative C to protect marine habitat and shorelines important for marine animals, waterfowl, and shorebirds (Elson Lagoon, Dease Inlet, Admiralty Bay, Wainwright Inlet/Kuk River, Peard Bay, and Kasegaluk Lagoon, and their associated barrier islands and, in the case of Peard Bay and Kasegaluk Lagoon, lands within 1 mile of those two waterbodies). This unavailable designation supersedes the current time-limited (2014) deferral for the Kasegaluk Lagoon Special Area.

Alternative C would place 9 million acres in Special Areas, increasing the size of the Utukok River Uplands Special Area and adding the 107,000-acre Peard Bay Special Area. The boundary of the Colville River Special Area would not change, but its purpose would be modified as explained in Alternative A.

All alternatives, including Alternative C, contain numerous stipulations and best management practices that would effectively protect special status species and their habitats in the NPR-A (see Alternative A for a full listing). These include Best Management Practices A-1 and A-2, which address the proper storage, handling, and disposal of solid, liquid, and hazardous wastes (including fuels), as well as Best Management Practices A-3 through A-7, which address hazardous material releases and oil spills through prevention, storage, handling, and disposal. The protection of special status birds, their habitats, and food sources are addressed by Best Management Practices B-1, B-2, C-2, C-3, C-4, D-2, E-9, E-12, E-18, Protection J and Stipulations E-2 and L-1, among others. Protection J would help minimize the take of species listed under the Endangered Species Act, as would Best Management Practices E-11 and E-18, which contain specific language aimed at reducing impacts to spectacled and Steller's eiders, including their nests and brood-rearing areas. A series of stipulations, including K-3, K-4, and K-8, provide additional protections in biologically sensitive areas and many of these provide protections to eider habitats and food sources. The "B" best management practices would help limit the impact of water withdrawals on lakes, or lake habitats, used by eiders, while the "C" best management practices govern seismic ground operations to prevent seismic activity-related disturbance to eiders and provide protection for over-wintering invertebrates, which are sources of food for eiders. The Teshekpuk Lake Special Area would be unavailable for leasing, and permanent oil and gas facilities (with the exception of pipelines) would be prohibited. This would restrict the total area that can be developed within areas, which are used in high density by nesting spectacled eiders. In addition, there are numerous best management practices and Stipulations that would protect some special status species and their habitats by regulating the types of activities that can occur near waterbodies, including rivers and streams, types of equipment that can be used, and types of exploration and development activities that can be conducted in the planning area.

Finally, Alternative C provides stipulations and best management practices that provide protection to surface resources that are nearly identical to those in Alternatives B-1 and B-2, and are superior to those in Alternative A. Alternative C allows for 76 percent of the NPR-A to be leased, while Alternatives A, B-2, and B-1 allow for 57, 52, and 48 percent, respectively. As there has been no oil or gas development yet in the NPR-A, it is difficult to determine the effectiveness of the above-mentioned best management practices and stipulations. Best management practices and stipulations that have been in effect in the NPR-A to date regulate exploratory activities, and thus far, seem to be effective in protecting special status species and their habitats.

Conclusion

Alternative C emphasizes the protection of surface resources, through best management practices and stipulations, at the same level as Alternatives B-1 and B-2, although less land would be unavailable in Alternative C than in B-1 and B-2. Alternative C would make 4.4 million acres of land in the Utukok River Uplands Special Area unavailable, which would protect less high-value habitat for special status species then Alternative A. Alternative C would allow more infrastructure into areas of very high value to birds than Alternative A, and in this aspect would be less protective than is Alternative A, perhaps resulting in an increased need for infrastructure that could cause habitat loss, disturbance, or mortality. A corridor for infrastructure associated with offshore development in the Chukchi Sea could be accommodated.

Alternative C would provide five Special Areas, including the creation of one new Special Area and the enlargement of two others (as compared to Alternative A), overall placing 9 million acres in unavailable for leasing status. Special Area designation does not itself impose specific protections, but instead highlights areas and resources for which BLM will extend "maximum protection" consistent with exploration of the Reserve. The 1.6-million-acre Peard Bay Special Area would be created with an explicit purpose of protecting nearshore waters for shorebirds and waterbirds. The purpose of two existing Special Areas would be modified to specifically include birds; shorebirds and waterbirds would also added to the Teshekpuk Lake Special Area, and all raptors (not just the arctic peregrine falcon, as originally stated) would be added to the Colville River Special Area.

Non-oil and gas activities that could potentially affect special status species would be the same as those in Alternative A. Under all alternatives, this analysis shows that impacts special status species from non-oil and gas activities would be minor.

A greater level of development would likely occur under Alternative C, as compared to Alternative A. The potential for habitat loss and alteration to affect special status species would be greater under Alternative C, as compared to Alternative A, as the amount of high-use spectacled eider habitat that would be lost to gravel infrastructure would be greater, and there would be a higher potential for infrastructure to be located in areas of high spectacled eider use in the Teshekpuk Lake Special Area. Stipulations and best management practices established for Alternative C would help to mitigate potential impacts to tundra-nesting birds. The potential for mortality of special status species resulting from collisions with vehicles (air or ground) or infrastructure and marine vessel traffic would be greater under Alternative C because the amount of infrastructure and barge traffic would be greater than in Alternative A. The potential for an oil spill to impact special status species would also be greater under Alternative C, as compared to Alternative A, given the estimated greater amount of infrastructure and development activity in this alternative.

Under Alternative C, the types of disturbances related to vehicle, aircraft, pedestrian, and vessel traffic, routine maintenance activities, heavy equipment use, facility noise, and oil spill and gas release cleanup activities would be similar to those described under Alternative A. Under Alternative C, types of impacts to birds would be similar to those discussed under Alternative A, but would be greater in frequency and extent because of the high oil and gas potential of the northern portion of the NPR-A, and the potential for greater development to occur, including in areas currently off-limits to surface development activities. It is expected that impacts to special status species in the vicinity of Teshekpuk Lake, and throughout the northern portion of the NPR-A, would be greater under Alternative C.

Stipulations and best management practices established under Alternative C would help to mitigate potential impacts to special status species. Effectiveness of stipulations and best management practices is unknown at this time, but they are presumed to be effective.

In general, impacts to special status species from non-oil and gas activities, and from oil and gas exploration and development activities, would be additive. Potential impacts from seismic activity would vary by alternative with Alternative A expecting to require five exploratory and six developmental seismic surveys (see Table 4-11 in Volume 2). Alternative C is estimated to require 14 total seismic surveys, which will cover a greater area than would be covered in Alternative A. The expected number of oil and gas fields and the level of development under Alternative C would be greater than under Alternative A. Therefore, it is expected that the potential effects of disturbance, habitat loss and alteration, and mortality of special status species due to oil and gas exploration and development under Alternative C would be greater that under Alternative A. All alternatives would minimize unintentional take of migratory birds and conserve migratory bird populations. The special status species susceptible to the greatest amount and types of impacts include those that regularly breed on NPR-A's tundra, where most activities would occur (i.e., Steller's eider, spectacled eider, yellow-billed loon, and short-eared owl). The remaining species (golden eagle, red knot, and Kittlitz's murrelet) would be infrequently exposed to activities, and would be susceptible primarily just to collisions and oil spills. In the absence of a large oil spill, none of the special status species would be expected to incur population-level effects from full implementation of Alternative C.

Although many of the forces driving global climate regime shifts may originate outside the Arctic, the impacts of global climate change are exacerbated in the Arctic (Arctic Climate Impact Assessment 2004). Temperatures in the Arctic have risen faster than in other areas of the world, as evidenced by glacial retreat and melting sea ice. Special status species whose range in Alaska is concentrated in the Arctic may be the most vulnerable to the effects of a changing climate. These species include yellow-billed loon, spectacled and Steller's eider, and red knot. Effects to these special status species from climate warming may include a suite of effects, both positive and negative. A longer open-water season may increase productivity of some species of shorebirds and increase productivity in aquatic and semi-aquatic systems, which provide food for yellow-billed loon and spectacled and Steller's eider. Warmer soil temperatures are likely to increase thermokarst, and increases in sea level may inundate low-lying tundra areas, increasing salt marsh, aquatic and wet tundra vegetation types, and erosion of coastal bluffs (Arctic Climate Impact Assessment 2004) causing changes in coastal habitats that may quickly result in changes in vegetation that influence habitat suitability and availability for spectacled and Steller's eiders (Mars and Houseknecht 2007). The increasing thickness of the active layer of soil above arctic permafrost is likely to cause changes in moisture regimes and the distribution of vegetation types over much of the Arctic in coming years. Drying of wetlands would result in negative effects to spectacled and Steller's eiders that rely on shallow water and wet meadows, and shrub expansion may reduce the quality and availability of some types of habitats. Such impacts could accelerate or exacerbate changes in soil thermal regimes that occur with development, potentially leading to greater impacts to special status species habitat. Increase in human economic activities such as shipping and offshore oil and gas development may influence the abundance and distribution of predators, which may negatively affect special status species populations. These changes may be beneficial to some special status species such as those associated with boreal forest or shrub habitats (golden eagle), but a reduction in the amount of tundra habitat available could negatively impact spectacled and Steller's eiders, red knot, and short-eared owl, and add to the cumulative effects of oil and gas development. High rates of coastal erosion and storm surges have led to saltwater intrusion into freshwater habitats, and such intrusions may alter foraging and brood-rearing habitats for spectacled and Steller's eiders.

4.6.11.3 Special Status Species of Terrestrial Mammals

Two species of terrestrial mammals listed as BLM Sensitive Species are described in section 3.3.8 in Volume 1. Neither of these has been found within the NPR-A in recent decades. The Alaskan hare has not been reported on the North Slope since 1951, and the Alaska tiny shrew has never been documented in the NPR-A. The types of impacts to these two mammalian species would be the same as those for all other terrestrial mammals. These impacts are described in section 4.6.9, and are repeated here only briefly.

Under Alternative C, development would be unlikely to affect either of these two species, primarily because it is unlikely that either exists in the NPR-A. This is especially so for the Alaskan hare, since if this relatively large-bodied species occurred in the NPR-A it would most likely have been documented one or more times in the last 60 years. It is more likely that the Alaska tiny shrew has occurred or does occur in the NPR-A without having been documented. If development facilities were constructed in an area containing a population of Alaska tiny shrew, adverse impacts to that population could occur. These impacts would most likely be manifested in the loss of habitat, and could also involve the deaths of some individuals if they were to be run over by heavy equipment during construction of development facilities.

4.6.11.4 Special Status Species of Marine Mammals

Activities Not Associated with Oil and Gas Development and Exploration

Baleen Whales

Effects of activities not associated with oil and gas exploration and development on bowhead, fin, and humpback whales would be similar to Alternatives A, B-1, and B-2.

Ice Seals

Aircraft and vessel traffic are the non-oil and gas activities most likely to have a direct impact on ringed and bearded seals. The potential effects of these activities are described under Alternative A. Impacts from activities not associated with oil and gas exploration and development would not differ from those described under Alternatives A, B-1, and B-2, and would be negligible.

Polar Bear

Winter overland travel is the non-oil and gas activity likely to have the most effect on polar bears in the NPR-A. Potential impacts to polar bears from this and other activities are described in Alternative A. No difference in the potential to impact polar bears, nor in the level of impact, would be expected between Alternatives A and C.

Pacific Walrus

Potential impacts from non-oil and gas activities would be similar to those discussed under Alternative A. No difference in the potential to impact walruses, nor in the level of impact, would be expected between Alternatives A and C.

Oil and Gas Exploration and Development Activities

Baleen Whales

Effects to bowhead, fin, and humpback whales from oil and gas exploration under Alternative C would be similar to the other alternatives, but might be somewhat larger due to increased acreage available for leasing. Increased acreage for leasing may result in increased barging of equipment infrastructure, and increased marine noise. However, unavailability for leasing and a prohibition of non-subsistence permanent infrastructure in the Peard Bay and Kasegaluk Lagoon Special Areas may result in less barging in these specific Special Areas and less noise imparted to the marine environment. Similar to Alternative B-1, the major coastal waterbodies of Elson Lagoon/Dease Inlet/Admiralty Bay would also be unavailable for leasing under Alternative C. No non-subsistence permanent infrastructure would be allowed except for buried pipelines under Wainwright Inlet/Kuk River, and no oil and gas exploration would be allowed between May 15 and October 15. These provisions would reduce impacts to baleen whales more so than under Alternatives A and D. There could be more impacts to bowhead whales east of Barrow than under Alternatives B-1 and B-2 because coastal areas east of Dease Inlet could be leased under Alternative C.

Seismic Activities. Effects from onshore seismic surveys would be similar to the other alternatives and not expected to affect cetaceans. The unavailability of oil and gas leasing in the Peard Bay Special Area and in Elson Lagoon/Dease Inlet/Admiralty Bay, and Wainwright Inlet/Kuk River may further reduce any noise from seismic testing to enter marine waters compared to Alternative A.

Shipping. Effects from shipping under Alternative C could correlate with the amount of acreage available for oil and gas activity in NPR-A. It is unclear if the protected marine areas (Peard Bay and Kasegaluk Lagoon Special Areas) would result in fewer nearshore barge transits in those areas and less noise produced in adjacent marine waters compared to Alternatives A and D, although large whales are not known to use these Special Areas. However, it seems likely the Cape Simpson and the Lonely region, areas where bowheads are known to feed, would be used as a staging area and some effects on bowheads from shipping may occur. These areas are not used by either fin or humpback whales.

Ice Seals

Potential types of direct and indirect effects on ringed and bearded seals from activities authorized under Alternative C do not differ from those described under Alternative A. Oil and gas-related effects, however, would likely be more limited than those disclosed under Alternative A, but slightly increased relative to Alternatives B-1 and B-2. Alternative C does not allow leasing or oil and gas-related development in Elson Lagoon, Dease Inlet, Admiralty Bay, Wainwright Inlet/Kuk River, Peard Bay, and Kasegaluk Lagoon, associated islands, and lands within 1 mile of Peard Bay and Kasegaluk Lagoon (Map 3-2). This is more named waterbodies than under Alternatives A or D. Unavailability would preclude the possibility of production oil spills directly into these important marine waters, and would protect ringed and bearded seals from most other direct impacts as well. The chance for an onshore spill to reach marine waters would also be more effectively minimized under this alternative relative to Alternative A due to the inclusion of twice as many rivers with setbacks in the K-1 Stipulation, and more coastal areas included in development restrictions of Stipulation K-6. Both species would still be sensitive to refined oil spills and discharge related to shipping traffic in support of onshore activities. Seals may also be affected by aircraft flights and marine traffic near terrestrial haulouts the same as in Alternative A.

Polar Bear

Seismic Activities. Because certain coastal areas would be unavailable for leasing, a lower level of overall disturbance to polar bears from seismic surveys would be expected under Alternative C than under Alternative A. Seismic surveys conducted near the coast could expose undetected polar bear dens to noise and associated disturbances, resulting in the displacement of maternal polar bears and their dependent cubs, abandonment of the den, and possible death of polar bear cubs. Best Management Practice C-1 would prohibit cross-country use of heavy equipment and seismic activities within one mile of known polar bear dens and would require operators to consult with the U.S. Fish and Wildlife Service before initiating activities in coastal habitat between October 30 and April 15. Depending on the suitability of the area for polar bear dens, the operator may also be required to survey for dens prior to seismic activities. This combination of procedures would minimize the chance that denning polar bears would be disturbed by seismic activities. Impacts to individual female polar bears and cubs would only occur in the unlikely instance that a den would go undetected during a survey. No population-level impacts are anticipated.

Exploration. It is estimated there could be up to 60 oil exploration and delineation wells and 184 gas exploration and delineation wells drilled under Alternative C. These wells are expected to be drilled from ice pads, causing short-term ground disturbance of 360 and 1,104 acres, respectively. The actual number of exploratory wells with potential to affect polar bears is not currently known; but only those wells drilled within 25 miles of the coast would have the potential to directly affect polar bears, and only those within 5 miles of the coast would have the potential to affect denning polar bears.

Exploratory drilling near the coast during winter (December to mid-April) would potentially disturb, displace, or attract polar bears. As described under Alternative A, the primary threat to polar bears would be disturbance to females in maternal dens and attraction of non-denning bears to support facilities.

Conservation measures have been established to protect female polar bears denning within 1 mile of construction activity. Best Management Practice C-1 would require all industrial activities to maintain a 1-mile buffer around known or suspected polar bear dens. In addition, oil and gas exploration activities within polar bear habitat would require coordination by the operator with the U.S. Fish and Wildlife Service to locate any potential polar bear dens prior to winter exploration activities.

Lease stipulations and Best Management Practices A-1 and A-2, which require proper waste prevention, handling, and disposal, would effectively prevent or minimize attraction of polar bears. Best Management Practice A-8, requiring implementation of a bear-interaction plan, would reduce the likelihood of negative human-bear encounters. These plans include measures to minimize attraction of bears to industrial facilities, methods for communicating to workers about bears in the area, and an outline of proper procedures to follow in the event that bears are observed near industrial facilities and work sites. Lessees would be required to keep a systematic record of bears on site and in the immediate area, which could be used to inform future stipulations and policies intended to minimize human-bear conflicts. Such requirements for facility management and human-bear interaction plans have been successfully implemented at oil and gas exploration and production facilities in other portions of the North Slope. It is anticipated that impacts to polar bears attracted to exploration activities in the planning area would also be minimized and actively managed to promote human safety, while limiting detrimental effects to the bears.

Development and Production. Exploratory drilling and non-subsistence permanent infrastructure would not be allowed in lands unavailable for leasing and in the Kasegaluk Lagoon and Peard Bay Special Areas, with the exception of a subsurface pipeline under the Wainwright Inlet/Kuk River or for infrastructure necessary for exploration, development, production, and abandonment of valid existing NPR-A oil and gas leases. Overall, less of the coastal area would be available for oil and gas development than under Alternative A. Surface disturbances would include gravel production pads and central processing facilities for oil and gas, gravel roads, gravel runways, and several types of pipelines (some of which may be buried). Under Alternative C, the long-term disturbance footprint would be 14,894 acres. The actual number of development and production facilities (and their associated gravel footprint) with potential to affect polar bears is unknown at present. Only facilities within 25 miles of the coast would be likely to directly affect polar bears, and facilities within 5 miles of the coast could affect maternal dens.

Impacts to polar bears, including disturbance, caused by development and production activities would likely be slightly less than those described for Alternative A, since some coastal areas would be indefinitely unavailable for oil and gas leasing.

The same avoidance and mitigation measures that would be employed during exploration would be utilized during development and production, including avoiding polar bear dens by 1 mile, minimizing polar bear attraction to facilities, developing human-bear interaction plans, and implementing training for facility personnel. Additionally, Best Management Practice E-5 would require that facilities be designed to minimize impacts of the development footprint, while Best Management Practice E-4 would require sound pipeline construction to minimize leaks; these practices would help minimize take of listed species.

Facilities would be designed and constructed to minimize impacts of the development footprint, using techniques such as directional drilling and collocation. Reduction in the potential footprint within coastal areas would confer some benefits to polar bears.

Oil Spills and Gas Releases. Alternative C, like Alternative A, poses some risk of small and large spills of oil, refined fuel, and produced water and potential for gas releases. Because these events could happen at any time of the year, polar bears could come into contact with unrecovered oil on land, on ice, or at sea. The results to the physical health of the bear would be the same regardless of location.

The impacts of oil spills and gas releases on polar bears are described in detail under Alternative A. Direct oiling could lead to hypothermia and result in increased energy costs or death. Oiled polar bears would ingest oil by grooming, and polar bears could also ingest oil by eating oiled seals or carcasses. Ingested crude oil is highly toxic to polar bears (Oritsland et al. 1981; Stirling 1990). Exposure to oil or associated fumes could cause respiratory distress and inflammation of mucous membranes and eyes, leading to abrasions and ulcerations. Even partial oiling of a polar bear is likely to result in mortality, while chronic low levels of exposure could result in sublethal effects that reduce fitness.

The risk of oil spills under Alternative C would be nearly identical to that under Alternative A. The number of small spills assumed for Alternative C is about 98 percent of that for Alternative A for both crude and refined oil spills, with the volume also estimated at 98 percent. Although the likelihood of an individual bear coming into contact with a small spill is very low under Alternative C, polar bears could avoid coastal areas that were fouled by oil or be displaced by response activities, resulting in impacts to fitness, breeding success, or survival. Effects of a small spill would be short-term (days to weeks), localized, and at most should affect very low numbers of individuals.

The risk of large spills for each alternative is based on the volume of oil expected to be produced over the life of the oil exploration and development that might proceed from leasing and discoveries in the NPR-A. For Alternative C, the percent chance of one large spill occurring is 37 percent. The risk of a large spill is higher under Alternative C than under Alternatives B-1 and B-2, the same as Alternative A, and slightly lower than Alternative D. The potential impacts to polar bears resulting from a large oil spill are discussed in Alternative A. Under any of the alternatives, the extent of impacts from a large oil spill would depend on the size, location, and timing of spills relative to polar bear distributions and on the effectiveness of spill response and cleanup. A population-level effect may be expected if a spill were to contact an aggregation of bears. Polar bears are generally widely dispersed in the planning area; and, in the event of a large oil spill, it is most likely that only a small number of polar bears would be directly affected through oiling. However, even a few individuals removed from the threatened populations of polar bears could be significant to the recovery of the local population, particularly if females or females with cubs were oiled. Response activities associated with a large spill also have the potential to disturb or affect polar bears; displace them from feeding, resting, and denning areas; and potentially contaminate their food chain.

As under Alternative A, there is a small potential that a large gas release could occur from a platform, pipeline, or onshore facility. Direct impacts to polar bears would be minimal because gas would quickly dissipate. Although a bear in the immediate vicinity could potentially experience impacts from inhaling gas, or be injured or killed if an explosion occurred with the release, these scenarios are unlikely. Impacts to polar bears may occur as a result of response activities. If disturbance caused polar bears to be excluded from feeding, resting, or denning areas, this could impact body condition, breeding success, or survival.

Effects of Abandonment and Reclamation. Effects of abandonment and reclamation would generally be similar to those under construction. Human activities, particularly visual and noise components, could disturb individual polar bears, including both denning and non-denning bears. Disturbance of known, denning polar bears would be avoided as during construction activities during the exploration and development and production stages. No population-level effect would be expected.

Pacific Walrus

The oil and gas activities that could affect walruses in Alternative C would be similar to those described under Alternative A, although the likelihood of walrus impacts would be less because of the relatively restricted areas of the Chukchi Sea coast available for oil and gas exploration and development. Two objectives of the Peard Bay Special Area and the Kasegaluk Lagoon Special Area are to protect the summer shoreline habitat for marine mammals (including walrus) and to prevent contamination of marine waters. Under Alternative C, Lease Stipulation K-6 may restrict permanent oil and gas facilities (including gravel pads, roads, airstrips, and pipelines) within the coastal area, which includes all barrier and offshore islands within the NPR-A and a coastal strip extending from ¾ of a mile to 1 mile inland from the coast. These protections would benefit walrus by restricting oil and gas development in the vicinity of several known walrus haulout areas on the NPR-A Chukchi Sea coast, yet still accommodate an offshore pipeline corridor at many locations along the Chukchi coastline. Under Alternative C, the Kasegaluk Lagoon Special Area and Peard Bay Special Area are much smaller in size than under Alternative B-1, but the same size as proposed for Alternative B-2. Coastal protections for walrus are similar along the Chukchi coastline as those under Lease Stipulation K-6, which applies to Alternatives B-1, C, and D.

Effectiveness of Stipulations and Best Management Practices

Baleen Whales

The effectiveness of stipulations and best management practices should be similar to the effectiveness of stipulations and required operating procedures in Alternative A and the stipulations and best management practices in the other alternatives.

Ice Seals

The stipulations and best management practices of Alternative C, as they relate to ice seals, are similar to the required operating procedures and stipulations in Alternative A Notable exceptions are Stipulations K1, K-3b, K-6, K-8b, and Best Management Practice C-1. Stipulation K1 would more effectively minimize the chance that an onshore oil spill would reach marine waters by including twice as many rivers as what are named in Alternative A (i.e., Alternative C uses the same list as Alternatives B-1, B-2, and D). Stipulation K-3b protects more major coastal waterbodies than Alternative A, but one fewer than Alternatives B-1 and B-2 (i.e., the Kogru River is excluded). Stipulation K-8b extends the no permanent development restriction of Kasegaluk Lagoon to 1 mile inland from the lagoon. The areas covered by Stipulations K-3b and K-8b would be unavailable for leasing, and therefore, under this alternative, would be a best management practice with applicability only to off-lease activities. Stipulation K-6 would be improved by adding more coastline to the restriction on development. Best Management Practice C-1 is made more effective in this alternative than in Alternative A, due to the explicit requirement for operators to conduct a survey to detect (and then avoid) seal birthing lairs for activities during the seal pupping season (through April 15). However, the possibility exists that lairs will remain undetected despite survey efforts. Stipulations and provisions for marine areas made unavailable for leasing are expected to be effective at minimizing impacts to ice seals within these areas. In addition, seals would be adequately protected within Special Areas, such as Kasegaluk Lagoon and Peard Bay where marine mammals are specifically listed as a main value to protect. As with all other alternatives, discharge from support vessels may not be effectively regulated through the A-series required operating procedures, and could result in impacts to both species.

Polar Bear

Many of the lease stipulations and required operating procedures in Alternative C would provide effective protection to polar bears and their habitats within the planning area. Best Management Practices A-1 through A-8 would ensure that solid, liquid, and hazardous waste do not attract polar bears or degrade their habitat. They would also require a public safety plan that includes bear interaction plans to avoid or minimize many potential human-bear conflicts. Best Management Practice C-1 would prohibit seismic activities and the use of heavy equipment within 1 mile of known polar bear dens and require lessees to comply with requirements under the Marine Mammal Protection Act. Best Management Practice E-5 would requires that facilities be designed to minimize impacts of the development footprint, while Best Management Practice E-4 would require sound pipeline construction to minimize leaks; these practices would help minimize take of listed species. Best Management Practice I-1 would require orientation programs for oil and gas personnel informing them of the importance of not disturbing biological resources, including endangered species and marine mammals. Protective measure J indicates BLM would not approve any activity that may affect a listed species, until it completes its obligations under applicable requirements of the Endangered Species Act. Best Management Practices/Lease Stipulations K-1, K-3, K-4, K-6, and K-8 through K-11 would confer some benefits to polar bears. These stipulations would: (1) limit activities along the banks of rivers and some lakes, reducing sources of disturbance in potential denning habitat; (2) limit activities in coastal habitats, reducing the potential for sources of disturbance and obstructions in this polar bear movement corridor; and (3) require year-round spill response capability during periods of broken ice or open water in certain inlets, bays, lagoons, and barrier islands important to polar bears.

Pacific Walrus

The measures that offer the greatest protection for Pacific walrus are the provisions of Alternative B-1 and Stipulation K-6 that prohibit new leasing and may restrict new permanent non-subsistence infrastructure in certain areas important to walrus, as described in section 4.3.11.4, "Oil and Gas Exploration and Development Activities" in Volume 2. Best Management Practice I-1 would require lessees to implement a program to inform personnel about the importance of not disturbing biological resources, including marine mammals. This required operating procedure should minimize the potential for direct disturbance to walrus from human activities.

Lease Stipulation K-6 for coastal areas under Alternative C was developed to protect summer shoreline habitat for polar bears, walrus, and seals. It would not allow establishment of permanent oil and gas facilities (including gravel pads, roads, airstrips and pipelines to support exploration and development activities) within the Coastal Area, which includes all barrier and offshore islands within NPR-A and a coastal strip extending three-quarters of a mile inland from the coast. The exception would be for valid existing oil and gas leases; in a case where the BLM has authorized a permanent facility within the Coastal Area, the lessee/permittee shall develop and implement a monitoring plan to assess the effects of the facility and its use on coastal habitat.

Under Alternative C, the Kasegaluk Lagoon Special Area would be composed of lands unavailable for leasing. K-8 would become a best management practice whose provisions would apply only to off-lease activities to develop valid existing NPR-A oil and gas leases outside of the Kasegaluk Lagoon. The K-8 requirement would not permit permanent oil and gas surface facilities within the boundary of the Special Area.

Conclusion

Baleen Whales

Under Alternative C, most impacts on bowhead, fin, and humpback whales remain associated with marine shipping and barging. Most of the impacts are disturbances related to marine noise, but ship/whale interactions are a possibility. Although the acreage available for leasing is higher under Alternative C than A, the added coastal areas unavailable for leasing could decrease marine noise and related disturbances in those nearshore areas. Similar to Alternatives A, B-1, and B-2, population-level effects are unlikely under Alternative C.

Ice Seals

Alternative C will more effectively protect bearded and ringed seals against development pressures than Alternative A, but will provide less protection than Alternatives B-1 or B-2. The most likely impact to ringed and bearded seals under Alternative C from non-oil and gas related activities would be haulout disturbance by aircraft and would be negligible. Impacts to ringed and bearded seals from oil and gas activities could include disturbance from aircraft, the potential for an accidental large or very large contaminant spill, and for ringed seals, disturbance to pupping lairs. Ringed seal pups would be adequately protected if lairs are surveyed and avoided as directed by Best Management Practice C-1. Alternative C provides for an increase in unavailable lands and Special Areas that will limit the effects of development on these species compared to Alternative A, but they are smaller than Alternatives B-2 and B-1. Some negative impacts could still occur to bearded and ringed seal that use marine areas within and adjacent to the NPR-A planning area.

Climate change effects when coupled with development could have increased adverse effects for these species. Ice-dependent species, such as ringed and bearded seals, may be more susceptible to effects of oil and gas activities due to the added stresses associated with diminished sea-ice habitat due to climate change. How either species adapt to changes in sea ice and snow conditions is currently debatable. Ringed seals have the greatest potential for negative effects through the loss of ice substrate for hauling out during critical energetic periods and lower quality pupping areas. Bearded seals are most likely to be impacted by sea ice loss through reduced availability of ice upon which to haul out for resting or pupping, reduced access to prey resources near haulout areas, and oceanographic changes associated with sea ice loss that favor more pelagic seal species (Cameron et al. 2010). The mechanisms by which effects of climate change and anthropogenic activities interact are unknown, but could range from synergistic to countervailing. The combined effects of climate change and development activities would be greatly reduced under Alternative C than under Alternative A , but less so than under Alternatives B-1 or B-2.

Polar Bear

Under Alternative C, approximately 76 percent (17.9 million acres) of the planning area could be offered in future oil and gas lease sales. Approximately 5 million acres would be unavailable for leasing. A corridor for infrastructure associated with offshore development in the Chukchi Sea could be accommodated. Alternative C would offer some measure of protection to some coastal areas that are important to polar bears. It is expected that under Alternative C, the potential effects of disturbance, habitat loss and alternation, and potential mortality due to development would be lower than under Alternatives A and D but higher than under Alternatives B-1 or B-2.

Non-oil and gas activities would be highly localized (e.g., worksites or camps) and/or transient (e.g., surveys and inventories). While non-oil and gas activities may result in disturbance to individual polar bears and may prevent some polar bears from using small portions of habitat temporarily, the activities are not anticipated to have long-term impacts to individual polar bears or measurable impacts at the population level. Consultations with U.S. Fish and Wildlife Service under the Endangered Species Act will address potential impacts associated with permitted non-oil and gas activities. Oil and gas activities may likewise result in disturbance to individual polar bears and may prevent some polar bears from using small portions of their habitat temporarily. Endangered species consultations will address those oil and gas activities that could affect polar bears and their critical habitat. Population-level impacts are, therefore, not expected as a result of oil and gas activities, with the exception of a large oil spill. Under some scenarios, a large oil spill could result in population-level effects or long-term impacts to the food chain. The likelihood of such an event occurring under Alternative C is higher than under Alternatives B-1 or B-2, but the same or nearly the same as under Alternatives A and D, respectively.

The primary concern for the Southern Beaufort Sea and Chukchi/Bering Sea polar bear populations, some members of which are found within the NPR-A, is loss of sea ice. The U.S. Fish and Wildlife Service and U.S. Geological Survey have predicted that without changes in the rate of sea ice loss, the polar bear may be extirpated from much of its range in the next 40 to 75 years (see section 3.3.8).

Pacific Walrus

Alternative C would make approximately 17.9 million acres (76 percent) of the NPR-A available for oil and gas leasing. However, leasing would not be offered in the existing 97,000-acre Kasegaluk Lagoon Special Area and a Peard Bay Special Area of 107,000 acres, allocated to protect habitat important to marine mammals and birds. Under Alternative C, the effects of most non-oil and gas activities on walrus would largely be avoided, although adverse impacts could be experienced due to aircraft and vessel activity too close to haulouts. Walrus would continue to be more profoundly affected by climate change.

4.6.11.5 Potential New Mitigation Measures

Potential Mitigation Measure 1—Surveys for Sensitive Plant Species (new best management practice)

The objective and requirement/standard would be the same as those described in section 4.3.11.5 for Potential Mitigation Measure 1—Surveys for Sensitive Plant Species. The potential benefits and residual/unavoidable impacts would be similar to those described for Alternative A at section 4.3.11.5.

Potential Mitigation Measure 2—Surveys for Sensitive Terrestrial Mammals (new best management practice)

The objective and requirement/standard would be the same as those described in section 4.3.11.5 for Potential Mitigation Measure 2—Surveys for Sensitive Mammals. The potential benefits and residual/unavoidable impacts would be similar to those described for Alternative A at section 4.3.11.5 in Volume 2.

Potential Mitigation Measure 3—Aircraft Avoidance of Walrus Aggregations (addition to Best Management Practice F-1)

The objective and requirement/standard would be the same as those described in Alternative A at section 4.3.11.5 for Potential Mitigation Measure 3— Aircraft Avoidance of Walrus Aggregations. The potential benefits and residual/unavoidable impacts would be similar to those described for Alternative A at section 4.3.11.5 in Volume 2.

Potential Mitigation Measure 4—Marine Vessel Avoidance of Walrus Aggregations (K-6 Stipulation-Coastal Area)

The objective and requirement/standard would be the same as those described in section 4.3.11.5 for Potential Mitigation Measure 4—Marine Vessels Avoidance of Walrus Aggregations. The potential benefits and residual/unavoidable impacts would be similar to those described for Alternative A at section 4.3.11.5 in Volume 2.

Potential Mitigation Measure 5—Vessel Operation (Addition to H-1 Best Management Practice)

The objective and requirement/standard would be the same as those described in section 4.3.11.5 for Potential Mitigation Measure 5—Vessel Operation. The potential benefits and residual/unavoidable impacts would be similar to those described for Alternative A at section 4.3.11.5 in Volume 2.

4.6.12 Cultural Resources

4.6.12.1 Activities Not Associated with Oil and Gas Exploration and Development

Under Alternative C, the types of non-oil and gas activities would be the same as those described for Alternative A (see section 4.3.2.1 in Volume 2), and the potential impacts to cultural resources would be the same.

4.6.12.2 Oil and Gas Exploration and Development Activities

Effects of Seismic Surveys

Under Alternative C, the level of seismic activity is anticipated to increase moderately over that of Alternative A (see section 4.3.12.3 in Volume 2). The increase could be as much as 18,316 survey or camp train miles, about 32 percent, and 180,788 surveying or camp train acres, an increase of about 34 percent. However, given the historically low impact from seismic activity, this is not regarded as a meaningful increase in terms of potential impact to cultural resources. Therefore, the probability of encountering and impacting scientifically significant cultural material under Alternative C remains low.

Effects of Short-term Disturbance: Exploration and Delineation Drilling

Short-term impact-producing activities include drill pads, roads, and airstrips constructed of ice and snow. Under Alternative C, it is anticipated that gas well drilling and delineation activities would increase moderately, causing significant increases in the construction of associated ice and snow infrastructure. Overall, this activity would increase about 434,000 acres, or 33 percent compared to that of Alternative A (see section 4.3.12.3 in Volume 2).

Despite the increase in acreage, the potential for impacts to cultural resources remains low, as modern exploration and delineation activities historically have had little impact on the resource.

Effects of Long-Term Disturbance: Development of Oil and Gas Infrastructure

Under Alternative C, the amount of potential surface or near-surface disturbance to cultural resources from construction of central processing facilities and associated satellite pads, roads, airstrips, pump or compressor stations, and gravel pits in regard to surface area is increased by slightly more than 5,400 acres, about 54 percent more than under Alternative A. About 52 million cubic yards of gravel would be mined, which would be an increase of about 14 million cubic yards, about 30 percent greater than under Alternative A. Also by comparison, the number of potential vertical support members is the same as Alternative A, and gas pipeline trenching could increase by 1,278 miles, nearly doubling the amount of surface disturbance and potentially adding slightly more than 5.1 million cubic yards to the total of excavated material. While the area of potential impact has increased, because pre-work cultural resource surveys are required, the level of potential impact remains relatively low.

Effects of Oil Spills and Gas Releases

Under Alternative C, the effects of spills on cultural resources would be essentially the same as discussed under Alternative A (see section 4.3.12.3 in Volume 2). As has been previously explained, although the area of potential impact has increased, the level of potential impact remains low. As stated in section 4.3.12.2 in Volume 2, there would probably be no adverse effect on cultural resources from a gas release.

Effects of Abandonment and Reclamation

As previously described in section 4.3.12.2 in Volume 2, abandonment and reclamation of short-term and long-term infrastructure, under most circumstances, would have limited, if any, impact on cultural resources.

4.6.12.3 Effectiveness of Stipulations and Best Management Practice

Under Alternative C, the primary safeguard for cultural resources is Best Management Practice E-13, which states that lessees will conduct a cultural resources survey prior to engaging in any potential ground-disturbing activity. There are other regulations, laws, and procedures, which also provide protections for cultural resources (see section 4.3.12.3 in Volume 2).

4.6.12.4 Conclusion

The primary potential impact to cultural resources would result from the surface or near-surface disturbance resulting from excavation of gravel, the laying down of gravel on the tundra for construction of the permanent facilities, and trenching. However, surveys for cultural resources are required to be conducted before excavation or any potential ground-disturbing activities could take place. Overall, given the effectiveness of the protections for, and the baseline data from past inventories and research regarding where cultural sites are most likely to occur, both non-oil and gas and oil and gas-related activities within the

NPR-A have a very low probability of adversely impacting cultural resources. The potential effect of climate change is the same as described for Alternative A.

4.6.13 Subsistence

4.6.13.1 Activities Not Associated with Oil and Gas Exploration and Development

Under Alternative C, non-oil and gas-related activities requiring permits from the Authorized Officer would be subject to the protective measures outlined in Chapter 2 as well as any other applicable federal, state, and North Slope Borough regulations. Activities not associated with oil and gas exploration and development include aircraft and watercraft use, research activities, (including remote camps associated with research), overland moves, and recreation. All of these activities have the potential to affect subsistence use. Refer to section 4.2.1 in Volume 2 for a detailed description of the types of non-oil and gas activities that may occur in the NPR-A.

Effects of Disturbance

Aircraft Use

Under Alternative C, the effects of aircraft use on subsistence would be the same as those described under Alternative A (section 4.3.13.1 in Volume 2). Aircraft could divert migrating or insect-avoiding caribou, as well as seals, walrus, and whales from subsistence use areas. Subsistence users have repeatedly stated during scoping meetings that aircraft traffic reduces harvest access and success (Nukapigak 1998; Ahtuanguruak 2003; Kaigelak 2003; Olemaun 2003). Disrupted harvests directly impact hunters in terms of lost time, effort, and resources (primarily fuel). Subsistence harvesters also describe the stress that occurs when they are out hunting, hear a helicopter operating nearby, and worry that the helicopter will approach and disrupt the hunt.

Watercraft use

Under Alternative C, the effects of watercraft on subsistence harvest would be the same as those discussed under Alternative A (section 4.3.13.1 in Volume 2): localized and temporary, possibly causing subsistence species to avoid the area of activity. The low level of watercraft use is not anticipated to significantly disrupt subsistence harvesters.

Research Activities

It is likely that scientific research and data collection that is related to climate change and endangered species will continue to increase regardless of lease sales. The effects of research activities would be similar to those described under Alternative A: possible temporary and localized diversions or disturbances of subsistence species. Research activities would primarily take place in the summer months and aircraft-based research would have the greatest likelihood of affecting subsistence harvest patterns.

Recreation and Film Permits

Recreational uses of the NPR-A include hiking, rafting, canoeing, wildlife viewing and bird-watching tours that are primarily conducted by commercial guiding companies. Six to 12 permits for recreation can be anticipated per year. Recreation would likely be limited to summer use of river corridors. The effects of recreation under Alternative C would be similar to those under Alternative A: recreation could disturb the movements and habitat use of subsistence species, causing a short-term, localized effect. Recreational users would likely frequent waterways shared with other users, such as subsistence hunters, potentially resulting in resource user conflicts. A significant increase in recreation could result in increases in user conflicts and greater effect to subsistence resources along highly utilized river corridors such as the Colville and the Utukok. The effects of these conflicts on subsistence harvest patterns would likely be localized and of short duration. As described under Alternative A, effects on subsistence species and harvest patterns caused by guided hunters in the NPR-A would usually occur outside the core subsistence use areas of NPR-A communities and would be localized and temporary.

Solid and Hazardous Waste Removal and Remediation

Solid and hazardous waste removal and remediation, including the monitoring of existing clean-up sites and aging infrastructure (e.g., wellheads) would occur under Alternative C in the same manner as described in section 4.3.13.1 in Volume 2 for Alternative A. These activities would involve site characterizations, transportation of equipment over ice roads or snow trails or barge, removal of hazardous materials, possible stockpiling of contaminated materials, and eventual disposal in an appropriate facility. Effects of waste removal and remediation under Alternative C would be the same as described for Alternative A: helicopter use, ice roads, and snow trails could cause temporary and localized displacement of resources, and barging presents risks to sea mammal and bowhead whale hunting. Short-term effects could include a “plume” created by clean-up activities and an increased potential for contamination of subsistence species, particularly fish, in areas around the cleanup site. Long-term effects could include a decreased potential for contamination of subsistence species. Effects on subsistence harvest patterns by this activity would be localized and temporary, although many contaminated sites are located near NPR-A communities and can therefore affect nearby resources such as fishing areas.

Overland Moves

Overland moves, such as supply trips to communities via Rolligon in the winter on frozen tundra, would occur only by permit and would be subject to the regulations outlined in Chapter 2. The effects of overland moves under Alternative C would be similar to those described for Alternative A: caribou, grizzly bears, polar bears, muskoxen, wolves, and wolverines could be displaced from the immediate area of the travel route, but the effects would be localized and would vary depending on the intensity and frequency of traffic.

4.6.13.2 Oil and Gas Exploration and Development Activities

Effects of Disturbances

Seismic Survey Activity

Under Alternative C, it is estimated that there will be up to six exploration-focused seismic surveys and eight production-focused surveys in the NPR-A. Approximately 24 percent more acres could be surveyed by seismic under Alternative C than under Alternative A.

The effects of seismic activity under Alternative C would be similar to those described under Alternative A (see section 4.3.13.2 in Volume 2), namely, displacement of game and disturbance of subsistence activities that can lead to loss of subsistence food; loss of time; loss of money; increased stress and anxiety; increased risk of equipment failure; and increased risk of loss of life or serious bodily injury.

Exploratory Drilling

The types of impacts from exploratory and delineation oil and gas drilling under Alternative C will be identical to those described under Alternative A in section 4.3.13.2 in Volume 2. Direct impacts to subsistence users and resources from an drilling operation would include displacement of resources away from the drill site; possible impacts to overwintering fish from water withdrawals, river crossings, and fuel spills near ice airstrips; and increased time, effort, and expense during hunting. Ice roads and/or packed snow trails are customarily used by local residents during the winter, both by snowmobile and truck/car. The presence of these types of access may concentrate hunting efforts along the route(s). In addition, increased traffic by locals increases the likelihood that resources such as caribou will be displaced from the route.

Summer activities associated with exploratory drilling involving the use of helicopters for access would result in displacement of resources due to aircraft or watercraft use; impacts to hunters from disrupted hunts; and possible increase in the amount of time, effort, and fuel needed to harvest displaced animals. Given the increase in proposed activity under Alternative C, the effects on subsistence use could be increased in extent and duration.

Development and Permanent Facilities

The types of impacts from development and permanent facilities under Alternative C would be identical to those that are described under Alternative A. Subsistence hunters would likely avoid development areas, resulting in a shifting of subsistence use areas away from permanent facilities, including pipelines and roads. Industrial activities could displace subsistence species from traditional harvest areas. Both winter and summer oil and gas activities could result in changes to nesting and molting habitat that affect waterfowl's use of the Reserve. Fish and fish habitats could be affected by water withdrawals, gravel mines, changes to hydrologic regimes due to infrastructure (e.g., pads, roads, causeways, docks, bridges and culverts), increases in turbidity and salinity, oil and hazardous materials spills, and access to new habitats. These activities have the potential to reduce fish populations, divert fish from their normal locations, kill large numbers of fish, or contaminate fish populations and habitat.

Subsistence hunters from all NPR-A communities could be affected by aircraft spooking caribou and other game, thus reducing harvest success and creating uncertainty and stress among subsistence hunters.

Alternative C would impact subsistence in:

- **Wainwright:** Wainwright's nearby coastal waterbodies (Peard Bay, the Kasegaluk Lagoon, Wainwright Inlet, and the lower section of the Kuk River) would be unavailable for leasing. Alternative C also provides for a 107,000-acre Peard Bay Special Area to protect haul-out areas and nearshore waters for marine mammals and migration and staging habitat for shorebirds and waterbirds, which provide extra protections from any oil and gas activity in important subsistence areas northwest of Wainwright. However, important Wainwright subsistence areas such as the Ivisaru River, the upper section of the Kuk River, and traditional subsistence camps at the confluence of the Kuk, Avalik, Kaolak, and Ketik rivers, are in areas that will become available for leasing in 2014 and where gas development is likely. Under Alternative C, the Utukok River Uplands Special Area provides stronger measures for oil and gas activities and thus protects much of the land (including the majority of the Kuk's three tributaries) that is critical for the Wainwright harvest of fish, caribou, and furbearers. However, the entire southern NPR-A is unavailable for leasing under Alternative A, which therefore provides stronger protection for a larger subsistence area south of Wainwright. Overall, the preclusion of leasing in nearby coastal waterbodies that is provided by Alternative C would likely prevent more direct impacts to Wainwright's subsistence resources and use areas than the protections provided by Alternative A.

- **Point Lay:** The most important protections that Alternative C would provide for Point Lay's subsistence use would be the preclusion of leasing and infrastructure in the upper portion of the Kasegaluk Lagoon. The Utukok River Uplands Special Area under Alternative C does not provide as much protection to Point Lay's subsistence use area as does the unavailability of leasing in the entire southern NPR-A that would occur under Alternative A. This would be a more significant difference for Point Lay than it would be for Wainwright. Point Lay subsistence users travel, hunt, and fish extensively along the Kokolik and Utukok rivers, and lower segments of these rivers flow through an area that would be available for leasing under Alternative C. Under Alternative C, that portion of the Utukok River that is in the NPR-A would be recommended as an addition to the National Wild and Scenic River System with the designation of Scenic. This could mean variable restrictions (i.e., larger setbacks) that would likely have the effect of providing more protection to subsistence species. However, such a designation would also likely attract more recreational rafters to the Utukok. The majority of recreational users who float the Utukok pull out above the core Point Lay/Wainwright subsistence use area and no increase in conflicts would be expected, although recreational users could create temporary and localized disturbance to subsistence species in the Utukok River Uplands Special Area.
- **Nuiqsut:** Alternative C would protect more of Nuiqsut's subsistence use area by putting in place special restrictions on oil and gas activities around the Kogru River and by increasing the coastal area setback to one mile from the west side of the Colville Delta to Tangent Point. Under Alternative C, the Teshekpuk Lake Special Area and the Teshekpuk Lake Caribou Habitat Area are enlarged towards the southeast, overlapping with Nuiqsut's high caribou use area. Alternative C also expands the Teshekpuk Lake Caribou Movement Corridor by 1,500 acres over its size under Alternative A, extending the area where permanent oil and gas facilities, with the exception of pipelines, is prohibited. The restrictions on oil and gas activities in these areas would protect the priority conservation areas (calving area and most of the insect relief area) for the Teshekpuk Lake Caribou Herd, thereby protecting a significant source of food for these communities. The amount of land around Teshekpuk Lake that would be rendered unreachable by directional drilling

due to restrictions on surface facilities under Alternative C is approximately three times larger than the amount of similarly affected land under Alternative A. Under Alternative C, the likelihood of Nuiqsut hunters shifting subsistence use areas away from their traditionally used areas around Teshekpuk Lake would be less than under Alternative A. The risk of oil and gas activity deflecting caribou away from their normal migration paths in the Teshekpuk Lake Special Area would also be less, and subsistence hunters that depend on the Teshekpuk Lake Caribou Herd would likely save time, energy, and money if they were not required to travel to uncharacteristically distant areas to find caribou.

- **Barrow:** Alternative C would protect more of Barrow residents' subsistence harvest areas than Alternative A because of the protections in the Teshekpuk Lake special Area described above for Nuiqsut and because Barrow's nearby coastal waterbodies (Elson Lagoon, Dease Inlet, and Admiralty Bay) would be unavailable for leasing and infrastructure. Several Barrow families have traditional subsistence camps at Peard Bay, an area that would be distinctly better protected under Alternative C because the bay itself would be unavailable for leasing and the Peard Bay Special Area would include stricter restrictions on oil and gas activities, neither of which is true under Alternative A.
- **Atqasuk:** Alternative C will likely provide greater protection for Atqasuk's subsistence resources and activities through the protections to the Teshekpuk Lake Caribou Herd described above and by the unavailability of leasing and infrastructure in Admiralty Bay, Dease Inlet, and Peard Bay.

Effects of Abandonment and Reclamation

Oil facility abandonment and reclamation activities include the removal of all equipment and facilities and the plugging of all wells. During these activities, subsistence resources and activities would be subject to impacts similar to those caused by construction as described under Alternative A (see section 4.3.13.2 in Volume 2). Following the abandonment and reclamation, subsistence resources would be subject to fewer impacts. If the gravel roads and pads were left in place and remained serviceable, they could be used by residents to access subsistence resources, possibly reducing hunting effort and time.

Effects of Spills

The types of effects of oil spills on subsistence resources under Alternative C are identical to those described for Alternative A in section 4.3.13.2 in Volume 2. Impacts would depend on the size and location of the spill: those on pads are less likely to have impacts, those on the tundra could affect small numbers of terrestrial mammals, and those that directly enter a waterbody could spread widely and be toxic to fish and waterfowl, leading to long-term, population level effects. Subsistence harvesters would likely not take caribou or other consumable resources from the general area. As described for Alternative A, the Iñupiat consider contamination from oil spills in nearshore waters to be a catastrophic possibility that would threaten their very existence (Brower 1976; Itta 2001). Impacts could include injury or death to bowhead whales and other marine mammals or a shift in the migration routes of these species. The loss of an important source of subsistence food would result in financial hardship and increased pressure on terrestrial subsistence resources. Such an event could also trigger a reduction in the International Whaling Commission subsistence bowhead whale quota, which would cause hardship for all subsistence whaling communities in Alaska, Canada's Arctic, and Chukotka. Although the types of impacts of oil spills would be identical under all alternatives, the fact that several nearshore environments in the NPR-A would be unavailable for leasing under Alternative C reduces the risk of spills in these particularly critical environments

4.6.13.3 Effectiveness of Stipulations and Best Management Practices

Many of the protective measures outlined in Alternative C are intended to ensure the continued health of subsistence resources and to promote a responsive relationship between subsistence users, the BLM, and oil and gas companies.

Alternative C provides important measures that are explicitly aimed at minimizing conflicts between subsistence users and other activities. H-1 is designed to prevent unreasonable conflicts by requiring that a prospective lessee/permittee consult directly with affected communities to discuss the timing, location, and methods of their proposed operations. An applicant must document its consultation efforts as part of its plan of operation and must submit the plan of operations to the National Petroleum Reserve in Alaska Subsistence Advisory Panel for review and comment. An applicant must submit said plan sufficiently early to provide time for review by the Subsistence Advisory Panel and, if necessary, for Government-to-Government consultation with Native Tribal governments. Among other items, the operations plan must describe methods the applicant will use to monitor the effects of the activity on subsistence and must describe how the applicant will keep potentially affected individuals and communities up-to-date on the activities and locations of possible conflicts with subsistence users. Whereas the objective of Required Operating Procedure H-1 under Alternative A is focused on oil and gas activities, the objective of Best Management Practice H-1 under Alternative C is expanded to reflect the fact that research and other events can also disturb subsistence areas and users.

In addition to the consultation process detailed in H-1, Best Management Practice H-2 is intended to prevent unreasonable conflicts between subsistence activities and seismic exploration by mandating that an applicant for seismic exploration shall notify local Search and Rescue operations of current and recent seismic surveys and shall notify in writing all potentially affected cabin and camp users.

Effectiveness of Stipulations and Required Operating Procedures/Best Management Practices on Subsistence Species

Many of the protective measures outlined in Alternative C are intended to minimize the surface impacts of oil and gas activities and to otherwise ensure the continued health of wildlife and subsistence resources. For a complete description of the measures under Alternative C that are designed to mitigate impacts to fish, see section 4.6.7. Measures designed to protect birds are described in section 4.6.8, measures designed to protect terrestrial mammals are described in section 4.6.9, and measures designed to protect marine mammals are described in section 4.6.10. Although Alternative A has a number of measures designed to protect subsistence species in particularly sensitive areas, a few of these areas (namely most nearshore waterbodies) would be more effectively protected under Alternative C because the area would not be available for leasing, and corresponding measures under Alternative C would only apply to existing leases. Measures that are particularly relevant to subsistence species are listed below and specific differences that would make the measures more or less effective under Alternative C are noted.

- A-4 minimizes the impacts of contaminants on fish, wildlife, and the environment, and A-11 would, for all permanent development, mandate the design and implementation of a study to monitor contaminants in subsistence foods.
- Measures that minimize disruption of caribou include E-7, K-9, K-10, and K-12. E-7, which regulates the characteristics of pipelines, would be more effective under Alternative C because it includes an additional requirement that all aboveground pipelines would have a non-reflective finish. Under Alternative C, the size of the Teshekpuk Lake Caribou Movement Corridor in increased in K-9. K-12 protects habitat of the Western Arctic Caribou Herd and has no comparable provision under Alternative A.
- K-6 is a measure that minimizes hindrance of caribou movement within caribou coastal insect-relief areas and its objective, under Alternative C, has been expanded to protect the summer shoreline habitat for polar bears, walrus, and seals. Alternative C also increases the width of the coastal strip to one mile, as opposed to the 3/4 -mile strip provided by Alternative A, from the Kogru River to Tangent Point.
- K-11 limits permanent surface disturbance in the lease tracts in the northeast of the Teshekpuk Lake Special Area to protect subsistence resources and activities
- To protect fish habitat, B-1 and B-2 regulate water withdrawals, K-1 establishes setbacks along rivers, and C-2 to C-4 protect streams and prevent additional freeze down of deep-water pools.
- K-3 minimizes disruptions to the natural qualities and functions of the Teshekpuk Lake Shoreline.
- K-3b sets significantly higher standards for oil and gas activities in major coastal waterbodies. Under Alternative C, the Kogru River, which is an important subsistence use are for Nuiqsut, is included.
- K-8b protects subsistence resources and activities in the Kasegaluk Lagoon Special Area from off-lease activities associated with valid leases outside of the Kasegaluk Lagoon Special Area.
- E-10 minimizes the chances that migrating waterfowl will strike oil and gas facilities during low light conditions.

Unlike Alternative A, Alternative C includes a provision (Best Management Practice H-3) that minimizes impacts to important subsistence species by prohibiting employees of the oil and gas industry or other permitted activities to hunt or trap while working. This measure addresses a key concern of subsistence hunters, which is the encroachment of and competition for resources posed by outside hunters.

Effectiveness of Stipulations and Required Operating Procedures on Subsistence Harvest Patterns

In general, best management practices and lease stipulations seek to protect specific resources by establishing spatial buffer zones around facilities and infrastructure, scheduling disruptive activities when there is the least potential for conflicts with other users, making efforts to include community residents in project planning, monitoring effects on subsistence resources, and making efforts to minimize the interference of oil and gas exploration and development activities and structures with subsistence resources and users. For example, I-1 is a measure that minimizes conflicts with subsistence users by requiring orientation programs for oil and gas company employees. These programs include information on location-specific environmental, cultural, and social concerns as well as information about subsistence activities and the potential of aircraft use to disturb subsistence users.

Aircraft use near traditional subsistence cabins and campsites during spring goose and fall caribou and moose hunting is a particularly common concern. By mandating minimum flight altitudes, Best Management Practice F-1 mitigates the effects of low-flying aircraft on wildlife. This is effective when practicable and when obeyed, however, it is difficult to enforce and, as mentioned above, there are three major exemptions: wildlife surveys, foul weather, and take offs and landings. Furthermore, the BLM has no authority over private aircraft or aircraft used by projects that do not have BLM permits. BLM-chartered aircraft and aircraft use by BLM permittees accounts for a small percentage of the aircraft use in the NPR-A, therefore the BLM is not able to effectively mitigate the wider problem. The BLM has implemented a system whereby subsistence users notify the BLM of problem aircraft and the BLM attempts to track down the pilots or owners of the aircraft. Nevertheless, aircraft interference with subsistence activities continues to be a primary impact of oil and gas and other activities in the NPR-A. Several residents of Nuiqsut contend that the nuisance caused by aircraft is at such a high level that they no longer support roadless development, which was previously the preferred option. According to these residents, roads and road traffic through town would have many advantages and disadvantages, but on the whole would be preferable to the high number of overflights that the community currently endures (USDOI BLM 2010).

Several measures provide specific limitations on development near subsistence sites. Lease Stipulations K-1, K-2, and K-3 would minimize impacts to subsistence cabins and campsites and disruptions to subsistence activities by prohibiting permanent oil and gas facilities (e.g., gravel pads, roads and airstrips, and pipelines) through setbacks areas around rivers, lakes, and coastal waterbodies. Lease Stipulation K-6 is intended to minimize impacts to subsistence activities from permanent oil and facilities in coastal areas by implementing, to the extent practicable, a setback of three-quarters of a mile from the coastline and by mandating the use of previously occupied sites (e.g., Camp Lonely, various Husky/USGS drill sites, and Distant Early Warning-Line sites) when possible. Other measures that are particularly relevant to subsistence harvest patterns include:

- E-1, which requires that all roads be designed to protect subsistence use and access to traditional hunting and fishing areas.
- E-2, E-3, E-6, and E-8, which maintain subsistence use and access to traditional subsistence fishing sites.

- E-7, which mandates pipeline height to provide for the safe and unimpeded passage of subsistence hunters.
- K-8b is the measure that regulates the Kasegaluk Lagoon Special Area, the objective of which is in part to protect traditional subsistence uses and public access to and through Kasegaluk Lagoon for current and future generations of North Slope residents.

The actual effectiveness of protective measures depends heavily on their ongoing implementation, on enforcement, and on the precise location of facilities and infrastructure. Effectiveness is also dependent on the sharing of local knowledge and on informed input from residents of affected communities. As described above, several measures are designed to ensure that subsistence hunters participate in plan design. However, municipal governments and tribal governments generally have limited funding and few paid staff, and members of these organizations feel overtaxed when asked to provide meaningful input to the BLM on proposed or permitted activities. This institutional overload affects subsistence users by placing increased, non-compensated demands on their time, further reducing the time available for subsistence pursuits. Many such NPR-A residents contend that the change from the prescriptive lease stipulations that were put in place by the 1998 Northeast IAP/EIS to the performance-based rules put in place by subsequent IAP/EISs forces them to spend more time defending subsistence interests because compliance is now defined in terms of meeting management objectives rather than adhering to absolute standards. The contention that it now takes more time to review and to effectively respond to industry proposals was reiterated during scoping meetings in 2010 (USDOI BLM 2010).

The BLM has found that performance-based regulations provide equal protection with greater flexibility and project relevance. The flexibility of the performance-based approach places greater reliance on on-going monitoring to ensure that regulations are in fact achieving the desired level of protection. The BLM is committed to directing the resources necessary for on-going monitoring, including support for the Subsistence Advisory Panel to provide oversight, exchange information, and develop solutions for emerging issues.

4.6.13.4 Conclusion

The effects of non-oil and gas activities on subsistence species under Alternative C would be similar to those that would occur under Alternative A. There could be more exploration and development-related scientific research under Alternative C than under Alternative A because more areas would be available for leasing. The impact of non-oil and gas activities is greatly dependent on the time and precise location of said activities. Activities would be, in most cases, of limited duration and magnitude, and effects on subsistence would be limited to the immediate area of the activity.

Primary impacts could include the avoidance of traditionally used subsistence areas due to development and aircraft use as well as anxiety over this loss; the deflection of caribou and other important subsistence resources from areas of activity; increased difficulty harvesting caribou and other subsistence resources; the necessity to make longer and more distant trips in order to have a successful harvest, and the increased cost, risk, and time commitment this entails. The effects of disturbance from permanent oil and gas facilities on terrestrial mammals during the production phase would be of relatively long duration, but would be local in nature. However, decreased opportunities to harvest terrestrial mammals could be especially problematic if climate change inhibits fall travel by delaying freeze up or causes subsistence species to shift their migration routes or schedules. If climate change causes Arctic Ocean ice to retreat farther from the shore, it will make the harvesting of whales and other marine mammals more difficult, which could in turn increase pressure to harvest terrestrial subsistence foods. Under Alternative C, both winter and summer oil and gas activities could result in changes to nesting and molting habitat that affect waterfowl's use of the Reserve. Fish and fish habitats could be affected by development activities that could potentially reduce fish populations, divert fish from their normal locations, kill large numbers of fish, or contaminate fish populations and habitat.

Subsistence activities in all NPR-A communities could be directly affected by development activities under Alternative C. Alternative C would make approximately 19 percent more acreage in the NPR-A available to oil and gas leasing than Alternative A, meaning that impacts to subsistence resources and conflicts with subsistence users could occur over a larger area. Alternative C does not provide the same level of protection for the southern NPR-A as Alternative A does, which could result in a significant increase in impacts to the communities of Point Lay and Wainwright if development occurs in their subsistence use areas. However, Alternative C provides for a Peard Bay Special Area and makes several small but cumulatively significant changes to borders in the Teshekpuk Lake Special Area, which would better secure key habitats of the Teshekpuk Lake Caribou Herd. Alternative C also makes several critically important coastal waterbodies unavailable for leasing, which protects subsistence access and resources and reduces the risk of oil spills in those particularly sensitive environments. Alternative C does not provide the same level of protection for subsistence resources and access that is provided by Alternatives B-1 and B-2, but it provides a greater level than Alternatives A or D.

4.6.14 Sociocultural Systems

Please refer to section 3.4.4, "Sociocultural Systems" in Volume 1 for background information on cultural values, social organization, and social health in the NPR-A's Iñupiaq communities.

4.6.14.1 Activities Not Associated With Oil and Gas Exploration and Development

Under Alternative C, the effects of non-oil and gas activities on sociocultural patterns would be the same under Alternative A. Please refer to section 4.3.14.1 in Volume 2 for a more inclusive analysis of the impacts of non-oil and gas activities on Iñupiaq sociocultural systems. The amount of research related to climate change and endangered species is likely to increase regardless of development scenarios. These research efforts and associated aircraft use could cause temporary and localized diversion or deflection of subsistence species for as long as the studies were underway. Furthermore, Alternative C could result in an increase in recreation in the NPR-A and a corresponding increase in the number of user conflicts, particularly along rivers that are recommended for Wild and Scenic River designation trips and also important for subsistence, such as the Colville. It is not expected that the amount of soil and hazardous waste removal would be greater under Alternative C than under the other alternatives or that the number of overland moves would change significantly. In general, effects from non-oil and gas activities under Alternative C would be temporary and localized, and would be unlikely to affect overall sociocultural patterns.

4.6.14.2 Oil and Gas Exploration and Development Activities

Oil and gas exploration, development, and production would require a seasonal network of snow and ice roads and a permanent network of production facilities, pipelines, power lines, and gravel roads, runways, and pads in the NPR-A. The amount of land that could be impacted by oil and gas activities under Alternative C is 19 percent more than Alternative A. The percentage of development associated with gas could be higher under Alternative C than under Alternative A and gas exploration and development activities would likely impact NPR-A communities that are currently less accustomed to development, whereas the estimates for oil development under Alternative C are lower. The overall extent of industrial development in the NPR-A could be greater under Alternative C than under Alternative A, although the unavailability of leasing in several nearshore environments in the NPR-A will reduce direct impacts to several NPR-A communities.

Effects of Disturbances

The types of effects on sociocultural patterns from disturbances caused by oil and gas activities under Alternative C would be the same as under Alternative A, but effects due to exploration and development for gas may increase in intensity and duration. Increases in the area available for leasing and exploration would correspond to an increase in effects to subsistence harvests as compared to those for Alternative A. The development proposed for the NPR-A would require increased staging and overland travel during the winter and in summer would require increased use of aircraft for supplies, equipment, and crew changes, as compared to the other alternatives. In all seasons, noise, lights, personnel, and traffic near oil and gas infrastructure could temporarily deflect or divert caribou in areas where activities are occurring. Gravel pads could provide caribou with insect-relief habitat, but these effects could change the distribution, timing, and location of the caribou harvest. Subsistence hunters could be diverted from oil and gas facilities at distances from 5 to more than 25 miles, which could require increased effort and expenditure on the part of subsistence hunters. Given the high gasoline costs on the North Slope, this would add additional cost to subsistence harvests. Increased fuel costs and wear and tear on hunters and their equipment could increase the need for search and rescue missions and could increase the need for wage labor to support subsistence pursuits. This would reduce the time available to pursue subsistence activities, which would result in sociocultural consequences such as increased stress and a decreased sense of well-being. These problems are discussed in more detail in section 4.6.21, Alternative C, “Public Health”. Increases in the speed, range, and reliability of outboards and snowmobiles have facilitated the mixed subsistence and wage economy, but do not compensate for impacts to subsistence harvest activities from continued development and production activities in important subsistence harvest areas. A shift in one community’s most heavily used subsistence areas may have regional sociological impacts. Relations in areas of overlapping subsistence use by residents of Nuiqsut, Atqasuk, and Barrow are relatively smooth, for example, but there is a risk that that could change if Nuiqsut users are increasingly forced into the traditional and more exclusive subsistence use areas of other communities.

As discussed under Alternative A, long-term change to sociocultural patterns would result from a weakening, through prolonged stress and disruptive effects, of traditional institutions that have stabilizing effects within the society. Activities occurring under this alternative could exacerbate those effects to a slightly higher extent than activities under Alternative A. These changes are already occurring on the North Slope because of migration to urban areas, onshore and offshore oil and gas development, more dependence on a wage economy, higher levels of education, improved technology, improved housing and community facilities, improved infrastructures, increased presence of non-Natives, increased travel outside of the North Slope, and increasing penetration of television and the Internet. Data from other circumpolar Inuit populations suggest that continued modernization is associated with a trend toward displacement of sociocultural systems, including: a trend toward less time being spent conducting subsistence harvest activities; less subsistence consumption among younger generations; a greater focus on a cash-based economy, as opposed to the egalitarian sharing network; an increased importance on the nuclear family, as opposed to the more-traditional extended family structure (Curtis et al. 2005; Nobmann et al. 2005; Condon et al. 1995). North Slope Borough institutions, such as the school district that promotes the teaching of Iñupiaq language and culture, the Arctic Eskimo Whaling Commission that negotiates with industry to protect Iñupiaq subsistence whaling interests, the North Slope Borough Department of Wildlife Management, and other regional and village Native corporations and organizations, have been working to prevent the weakening of traditional Iñupiaq cultural institutions and practices. A number of social impacts are associated with increased contact with outside groups; however there currently appears to be a high level of separation, acceptance, and indifference between residents and workers in NPR-A communities. Under all alternatives, it is estimated that an influx of oil and gas workers today would represent a negligible fraction of the overall impact from modernization and the global economy.

Effects of Abandonment and Reclamation

At present, very few NPR-A residents have jobs in the oil fields (Circumpolar Research Associates 2002). Abandonment and reclamation activities would likely generate jobs for local residents for several years and at greater levels of employment than would exist during the operational phase. If local residents were to become substantially integrated into oil field operations, their families could face economic difficulty as fields were abandoned. North Slope communities, due to the support of the North Slope Borough, are already dependent on revenues associated with oil development. If no oil fields were active in the area to provide jobs and contribute economically to the local economy and government revenue, the community would face a time of economic depression, which is associated with increased social pathology in Iñupiaq communities, as discussed in section 4.6.21, "Public Health." The Arctic Slope Regional Corporation dividends, which are less dependent on local resource development, could provide some mitigating financial support if oil and gas revenues decrease. However, no potential avenues for maintaining income at the standards established in the oil development era have been identified. Abandonment and reclamation activities would restore habitat for caribou and other subsistence species and subsistence resources would thereafter be subject to fewer impacts, potentially improving subsistence opportunities.

Effects of Oil Spills

Under Alternative C, the likelihood of a spill event with the potential to damage unique critical habitats and subsistence use areas is the same as under Alternative A. Therefore, the effects of oil spills would be the same as those discussed in Alternative A: effects would vary in severity depending upon the timing and location of the spill event, but fish, waterfowl, and marine and terrestrial mammals could all be affected. An oil spill could result in contamination of subsistence resources and would be a threat to the health and lifestyle of the affected communities. If a large oil spill occurred in a traditional use area, then subsistence users would have to travel further to harvest uncontaminated resources, which could result in high effects to sociocultural patterns for a much longer time than the period that subsistence resources would be measurably contaminated. An oil spill that reached coastal waters could affect the harvest of marine mammals, including bowhead whale harvests, which are at the center of Iñupiaq sociocultural organization. The preclusion of leasing in several nearshore coastal waterbodies under Alternative C is a management action that significantly reduces the threat of an oil spill in these particularly important environments.

Activities associated with cleanup of an oil spill could have an effect on sociocultural systems. In the event that a large spill contacted and extensively oiled habitats, the presence of hundreds of humans, boats, and aircraft would increase the displacement of subsistence species and alter or reduce access to subsistence species by subsistence hunters. These events would supply short-term employment for local residents, potentially at the expense of subsistence activities and subsistence resource availability. Because it is expected that oil spills from authorized activities would be small events and would normally be contained on the drill pad, effects from the spills themselves and potential disruptions from clean-up activities would be unlikely to cause excessive disturbance to sociocultural systems or the surrounding environment. A large oil spill, however, would be catastrophic to the sociocultural structure of the whaling peoples of the North Slope if it were to occur in a riverine, nearshore, or marine environment.

4.6.14.3 Effectiveness of Stipulations and Best Management Practices

The management actions proposed under Alternative C make oil and gas leasing unavailable in several culturally and environmentally important coastal waterbodies, enlarge two Special Areas, and create one new Special Area. A few stipulations and protective measures (i.e., K-3, K-5, K-9) that would be put in place by Alternative C provide a higher level of protection along several rivers and in other sensitive areas. Because subsistence is an inherent component of cultural values, kinship, and social health, the description of the measures under Alternative C that are relevant to subsistence species and subsistence access in the previous section is also applicable to this summary of sociocultural impacts. The BLM would continue to work with appropriate state agencies on a plan to remediate or plug Legacy Wells giving priority to public health and safety and resource protection. The BLM would also continue to work closely with responsible parties to encourage cleanup of contaminated and solid waste sites in the NPR-A, such as Former Used Defense Sites and Air Force installations. Best Management Practice H-1 provides opportunities to affected communities for participation in planning and decision making to prevent unreasonable conflicts between subsistence users and oil and gas related activities.

A change that could be relevant for sociocultural issues is that Best Management Practice H-1 is expanded under Alternative C to provide for participation regarding all activities that might impact subsistence users, not just oil and gas activities. This Best Management Practice would allow NPR-A residents to be more aware of science and research projects in their region and to suggest changes or additions to those projects so that Iñupiat sociocultural systems are better served by them.

Particularly relevant for sociocultural systems is Best Management Practice I-1, which would require the lessee to provide a cultural orientation program for all oil and gas personnel involved in NPR-A activities in order to effectively minimize cultural and resource conflicts with local inhabitants. This orientation program, as it relates to subsistence pursuits and cultural concerns, would: (1) provide sufficient detail to notify personnel of applicable lease stipulations and required operating procedures, as well as inform them about specific types of environmental, social, traditional, and cultural concerns that relate to the region; (2) address the importance of not disturbing archaeological and biological resources and habitats, and provide guidance on how to avoid disturbance; (3) be designed to increase sensitivity and understanding of personnel to community values, customs, and lifestyles in areas where personnel would be operating; (4) include information about avoidance of conflicts with subsistence, commercial fishing activities, and pertinent mitigation; and (5) include information for aircraft personnel concerning subsistence activities and areas and seasons that are particularly sensitive to disturbance by low flying aircraft (e.g., aircraft use near traditional subsistence cabins and campsites, flights during spring goose hunting and fall moose hunting seasons, and flights near North Slope communities).

4.6.14.4 Conclusion

Alternative C makes nearly 17.9 million acres (76 percent of the total in NPR-A) immediately available for oil and gas leasing. This allows for development to sustain North Slope Borough revenues and thus to sustain the important socioeconomic support the North Slope Borough provides in NPR-A communities, although it does not alleviate the long-term issue of maintaining income at the standards established in the oil development era.

The types of sociocultural impacts that will occur as a result of the management actions of Alternative C will be the same as those of Alternative A. If marine traffic increases in near shore areas, bowhead whales could be deflected or their behavior made more dangerous to hunters (North Slope Borough 2004). Traffic around communities could isolate the community from subsistence resource harvest areas and could prevent residents from using their homelands, subsistence cabins and camps, and unspoiled open areas for resource harvests and pursuits. This would further degrade the quality of life and connection of people with their land and environment. In addition, should harvests decrease, resources would no longer be available in amounts suitable for sharing, resulting in changes in social organization and cultural values. However, several areas that are of importance to subsistence users, including areas surrounding subsistence camps, critical habitat for subsistence species, and large concentrations of historic and prehistoric cultural resources, would be better protected from the impacts of oil and gas activities under Alternative C than under Alternative A. Use of these areas helps maintain family connections and a feeling of relatedness and stability, which could be secured by the increased protections.

While federal subsistence management responsibilities would remain unchanged under all alternatives, many subsistence users in NPR-A communities are doubtful about the consultation process and about the BLM's commitment to protecting subsistence and the subsistence culture. The BLM initiates consultation by informing interested parties of the proposed action, and inviting said parties to participate in consultation. Some NPR-A residents are frustrated by the reoccurring demands put on them to review and provide relevant comments on IAP/EISs every few years and on each industry proposal as they arise. Efforts to participate in consultation or other management processes can be seen as futile, leading to decreased participation, decreased interest in cooperation with agencies, and increased conflict between agencies, lessees, and local resident groups. The management actions and protective measures that would be put in place by Alternative C would alleviate this tension to an extent because the culturally important Teshekpuk Lake Special Area and nearshore environments would be more secure. Alternative C addresses community subsistence concerns to a greater degree than Alternative A and thus could create less social stress and fewer threats to Iñupiaq sociocultural systems.

4.6.15 Environmental Justice

4.6.15.1 Activities Not Associated With Oil and Gas Exploration and Development

The non-oil and gas activities likely to occur in the planning area would primarily be transitory in nature, of short duration, and highly localized. They could temporarily divert, deflect, or disturb subsistence species from their normal patterns. Non-oil and gas activities could alter the availability of subsistence species in traditional harvest areas, which could affect harvest patterns by requiring hunters to travel further in pursuit of resources. Increased travel distances would result in greater expenditures for fuel and equipment, and increased wear and tear on snowmobiles, outboards, and four-wheel vehicles, and could result in higher risk of accidents. Consequently, there could be an effect on the subsistence hunting activities of the local minority population as a result of non-oil and gas activities. As outlined in section 4.6.21, this could result in isolated problems of social pathology. Under Alternative C, these effects would be the same as under Alternative A: minor, temporary, short term, and generally highly localized.

4.6.15.2 Oil and Gas Exploration and Development Activities

Effects of Disturbance

Under Alternative C, disturbances caused by oil and gas activities would be the same as those discussed under Alternative A and could extend to more areas of the NPR-A. However, the risk of negative effects to Iñupiaq communities and subsistence use areas would be decreased under Alternative C due to protections of several key areas that are culturally important and critical for subsistence harvests. Areas that would be unavailable for year-round occupation and development under Alternative C could be affected by oil and gas development activity that could last at least 30 years, following 8 to 12 years of permitting, planning, and oil deposit testing and delineation. This timeframe would likely represent the duration of effects for species unable to habituate to the oil and gas development activities. Public health effects relating to sociocultural and dietary change, as well as exposure to contaminants, could persist for considerably longer.

As described in section 4.6.9 "Terrestrial Mammals," Alternative C could have long-term effects on several terrestrial mammal species. Little or no effect on marine mammals would be expected from onshore activities under Alternative C, but noise and disturbance associated with offshore barge and vessel traffic could impact bowhead whale migration patterns. There are concerns that, depending on the particular activity and, especially, the location of the activity, actions occurring under Alternative C, as under Alternative A, could cause local effects on fish populations. All of these effects would be experienced primarily by the subsistence-dependent minority Iñupiaq population.

Possible public health impacts under Alternative C would occur primarily through restriction in subsistence, new access routes to communities, sociocultural and economic change, altered employment, and contaminants. If subsistence is curtailed or if sociocultural changes lead to alterations in dietary patterns, diabetes, hypertension, and related metabolic disorders would be expected to increase. Given that Alternative C involves less development in and near particularly sensitive habitat and hunting and fishing areas than Alternative A, the risk of dietary change and the resultant increases in metabolic disorders would appear to be less. Cancer, lung disease, endocrine disruption, and neurodevelopmental delay are related to contaminants common to oil and gas development, although at present no evidence exists to conclusively link rates of any of these problems to local oil development. Social pathology could result from the economic changes; from increasing access to drugs and alcohol; and from stress and maladaptive coping if impacts to wider regions of important traditional use areas occur.

Effects of Abandonment and Reclamation

Abandonment and reclamation activities would likely generate jobs for local residents for several years and at greater levels of employment than would exist during the operational phase. Activities associated with dismantling and removing of production pads and facilities could disproportionately impact NPR-A residents through disturbance, displacement, and mortality of subsistence resources, through subsistence users' avoidance of areas undergoing dismantlement and removal, and through potential impacts to water, air quality, and noise. Once abandonment and reclamation were completed, NPR-A residents would be disproportionately impacted by the reduction in local and Native corporation revenues and by fewer local jobs and business opportunities. Since economic depression is associated with increased social pathology, this could result in increases in domestic violence, injury, drug and alcohol problems, and suicide. Local residents could benefit from a reduction in impacts on subsistence resources, compared to during construction and operation.

Effects of Oil Spills

As discussed elsewhere, the magnitude of effects of a crude oil spill on subsistence resources would depend on the context of the spill, the volume and area covered by spilled product, and the amount of time the product was released before clean-up efforts commenced. Tundra oil spills could affect small numbers of terrestrial mammals and waterfowl unable to avoid the spill area, but would be unlikely to have population level effects. Oil spills directly into a water body, particularly in difficult to contain conditions such as breakup or broken ice, could spread widely and have effects on fish and waterfowl. In the nearshore environment, a large spill, particularly during broken ice or storm conditions, could affect marine mammals including seals, and beluga and bowhead whales. Oil spills can also be associated with toxicological health effects in human populations, as outlined in section 4.6.21. Furthermore, if a large spill resulted in a substantial decrease in consumption of subsistence foods, food insecurity and hunger as well as diabetes and related metabolic disorders could increase.

The Iñupiat consider contamination from oil spills in nearshore waters to be a catastrophic possibility that would threaten their very existence, primarily because of the potential effects of spills on bowhead whales, which are a very important part of their culture in addition to being a favored food source (Brower 1976; Itta 2001). Although oil and gas activity would potentially occur over a larger area in the NPR-A under Alternative C than under Alternative A, potential effects on subsistence harvest patterns would be less under Alternative C because of the protections to key subsistence areas. A major oil spill on the North Slope would result in effects that would impact Iñupiaq subsistence users more than any other human group.

4.6.15.3 Effectiveness of Stipulations and Best Management Practices

The lease stipulations and BMPs for Alternative C would protect subsistence resources to a greater extent than the lease stipulations under Alternative A. Best Management Practices H-1 and H-2 would be highly effective in reducing conflicts between subsistence uses and oil and gas-related and other potentially disturbing activities.

4.6.15.4 Conclusion

Several lease sales have already taken place in the planning area and additional exploration programs and development are expected. The effects of these activities would continue under Alternative C, but would be reduced as compared to Alternative A because of the unavailability of leasing in severally critically important subsistence and cultural areas such as Elson Lagoon, Dease Inlet, Admiralty Bay, Kasegaluk Lagoon, and Wainwright Inlet/Kuk River. Most effects of disturbance would still be short term. Effects from oil spills would depend greatly on the size, location, and season of the spill. Small spills on gravel pads would have little or no environmental justice effects. A major spill into a watercourse, on the other hand, could have long-term serious effects on Iñupiaq subsistence activities. While any large spill would have serious consequences, the worst from an environmental justice standpoint would be one that occurred in a key harvest area or near a community. The risk of such a spill is reduced by the unavailability of leasing in several coastal waterbodies under Alternative C.

Although reduced as compared to Alternative A, the activities likely under Alternative C could have substantial health effects, as outlined above and discussed in detail in section 4.6.21. Because the population within and near the planning area is primarily comprised of Iñupiat, any health effects that occur would disproportionately affect this minority population.

4.6.16 Recreation Resources

Alternative C would allow leases to be offered for oil and gas exploration and development on 76 percent of NPR-A subsurface lands. Another 1.57 million acres would remain deferred from oil and gas leasing until 2014; and 425,000 acres would be deferred until 2018. There are 9 million acres that would be recognized as special areas (Teshekpuk Lake Special Area, Colville River Special Area, Utukok River Uplands Special Area, Kasegaluk Lagoon Special Area, and Peard Bay Special Area). Alternative C would recommend three rivers be designated as Wild and Scenic Rivers.

4.6.16.1 Activities Not Associated with Oil and Gas Exploration and Development

Under Alternative C, recreation resources could be affected in the same way as Alternative A from activities not associated with oil and gas exploration and development. Alternative C provides for smaller additions to special areas than Alternatives B-1 and B-2, and makes unavailable for leasing the southern portion of NPR-A, which has the greatest potential for providing a primitive recreation experience. These would not change the effects of activities not associated with oil and gas, as compared to Alternative A.

4.6.16.2 Oil and Gas Exploration and Development Activities

Ice Roads, Ice Pads, Airstrips, and Snow trails

Ice roads, pads, airstrips, and snow trails are temporary in nature and traversed during the winter months. Ice roads provide seasonal routes for heavy equipment supplies and movement of personnel to remote staging areas or well locations. Ice airstrips are used to transport crews and supplies to and from sites. Snow trails provide seasonal routes for use by low-ground-pressure vehicles and are used for moving equipment, supplies, personnel accommodations, and drill rigs capable of disassembly to components small enough for transport on such vehicles. Under Alternative C, the estimated total seasonal acres impacted by ice roads, ice pads, airstrips, and snow trails is 432,669 acres or 144,668 miles. Activities in the winter would be far less visible because of the limited daylight hours. Due to the remoteness and climate of the Reserve, and typical type and frequency of recreation use taking place in the winter, there would be minimal, if any, effect from these activities.

Seismic, Exploration and Delineation Wells

Under Alternative C, there could be up to 14 seismic surveys, 6 exploration-focused and 8 production-focused, for a total estimated short-term impact of 718,894 acres or 74,953 miles for surveying and camp train use under Alternative C. The surveys use low-ground-pressure vehicles to minimize potential impacts to the tundra. The typical survey lasts about 100 days. Seismic camps, which generally consist of six camp strings of five ski-mounted trailers, are typically moved every few days to once a week. On-shore seismic surveys on the North Slope are only collected in the winter. The activity would be temporary and disturbance lasts only while the survey or camp train is passing through.

Exploration drilling that has taken place since 1999 involved no more than two drill rigs active simultaneously in the Reserve in any given season. The estimated number of drill rigs per year under Alternative C for exploration and delineation is three oil rigs and four gas rigs. While a rig could be used for multiple wells, each rig could only be used at one site at a time. Typically, drill rigs are removed from the Reserve at the end of the winter drilling season. Drilled wells are either plugged or capped for reentry at a later date. Capped wells have a pipe which would likely be less than 6 feet tall and surrounded by a 6-foot square short fence. The pipe could be a long-term impact, but would be almost unnoticeable from several hundred feet away. Approximately 1,464 acres would have short-term impacts from exploration and delineation wells under Alternative C. Recreation resources could be minimally impacted from the moving camps and associated noise from generators, aircraft, and human presence.

Activities in the winter would be far less visible because of the limited daylight hours. Due to the remoteness and climate of the Reserve, and typical type and frequency of recreational use taking place in the winter, there would be minimal, if any, effect from these activities. The impacts would be minimal, temporary, and confined to the immediate area. However, the presence of oil and gas winter activity could be beneficial to recreationists in the case of an emergency, as a means of communication and/or medical help.

Gravel Pads, Roads, and Airstrips

As part of production activities, an airstrip, camp facilities, and a storage yard would be needed. A borrow site from which to acquire gravel for pads, roads, and an airstrip may be a part of each production operation, but depending on the availability of gravel and the proximity of production operations, some borrow sites may provide gravel for multiple production operations. The only visible disturbance associated with gravel sites from borrow pits would generally only be stockpiled materials. While these sites could be large in size or footprint (about 37 acres each), very little material would remain as stockpile at any one time. Gravel mine sites from above ground bedrock locations may produce scenic impacts if material is removed from rock outcrops within the planning area. Airstrips would usually be located near a central processing facility for transporting supplies and personnel to the field site.

While the intensity of impacts would be greatest during actual construction and development of these facilities, remaining structures, human presence, and associated activity and noise all could have impacts on recreation resources during the life of the activity. Because production could occur for 10–50 years beyond the development phase, impacts would be long-term. Impacts would be greatest within 1 mile of a road, airstrip, or gravel site, and 2 miles of a pad. The estimated long-term disturbance for central processing facilities, booster pump stations, compressor stations, and staging bases in Alternative C is 765 acres. The greatest impacts to recreation would be within 2 miles of one of these sites. The estimated disturbance for in-field gravel roads, airstrips, gravel pads, and gravel pits in Alternative C is 10,831acres. At this time, it is not known what the layout of this infrastructure would be. Assuming all roads, pads, pits, and airstrips do not overlap with other infrastructure, a 1-mile impact zone for roads, airstrips, and gravel pits, a 2-mile impact zone for pads and associated facilities, the approximate total number of acres impacting recreation resources is 3,152,395 acres.

The relative proportion of the gravel roads, airstrips, and pads to the Reserve size is minimal. Once built, they would be used year-round. Due to the climate of the Reserve, recreationists would be more likely to see the roads in the summer than winter. However, since this infrastructure would be a part of production activities, they would most likely be off limits to the public. Displacement of recreationists from these areas would adversely affect recreationists' experiences and desired beneficial outcome from use of the public lands. However, the degree of the effect would depend on the actual location of the infrastructure; generally infrastructure distant from routes of travel by recreationists would have little to no effect on recreationists.

The discovery and development of commercial fields is likely to occur gradually across the NPR-A. During production, there would be a production pad, which could potentially support dozens of wells and contain a large central processing facility for an oil field or a combined central processing facility and gas compressor facility for a gas field.

The central processing facility would typically include living quarters and offices, maintenance shops, storage tanks for fuel and water, power generators, waste-treatment units, a communications center, communication towers, aircraft towers, and compressors for gas and water reinjection. They would be constructed as transportable modules, which would be supported above the ground on pilings to accommodate ground settling or frost heaving. Communication towers could be as high as 200 feet and well-lit.

Recreation resources would be affected by possible displacement, if the activity were to take place at a site previously used for recreation. The actual effects would depend greatly on where development fields were located. The oil and gas facilities, equipment, noise, night lighting, and human activity could alter the recreation setting to an industrial setting, which would interfere with recreationists' goals, and influence their opportunities, activities, experiences, and benefits.

Pipelines

The production operation would include feeder lines, regional pipelines, booster pump (oil) or additional compression stations (gas), a high-pressure gas trunk line, a gas conditioning facility and an oil-sale and/or gas-sale pipeline to transport the resource to market. The actual locations of new pipelines in the NPR-A would depend on the location and sequence of commercial-sized discoveries. Aboveground pipelines for oil would be the preferred method, while gas pipelines would be underground.

Oil pipelines would create a minor visual impact to recreationists who happen to see them, for the length of time that they are in view. While gas pipelines would not be visible, vegetation over the gas pipelines would indicate their location. The dirt work involved with underground pipelines could leave a change in the vegetation (see section 4.6.5, "Vegetation") that would benefit recreationists by creating an easier walking area. Pipelines and associated human activity could alter the recreation setting to an industrial setting, which would interfere with recreationists' goals, and influence their opportunities, activities, experiences, and benefits.

Once built, a pipeline would have a long-term impact on the area. Due to the climate of the Reserve and typical recreation activity, a pipeline would be more likely to be seen in the summer months than the winter months.

The estimated long-term disturbance (life of the project) for gathering or feeder lines, gas pipelines, and oil pipelines in Alternative C is 3,720acres. During the construction phase of these activities, the short-term disturbance is estimated to be 15,778 acres. Short-term impacts would be minimal, temporary, and confined to the immediate area (i.e., within approximately one-half mile in any direction). Assuming a 1-mile impact zone on either side of pipelines the total long-term impacts to recreation resources from oil and gas pipelines would be approximately 3,477,760 acres.

4.6.16.3 Effectiveness of Stipulations and Best Management Practices

Although the lease stipulations and best management practices of Alternative C do not specifically address recreation resources, many of the lease stipulations and best management practices of Alternative C would serve to protect recreation resources such as Best Management Practices A-1through A-7, A-9, B-1, B-2, C-4, E-6, E-7, E-8, and F-1, and

Lease Stipulations D-1, E-2, E-3,K-1, and K-2. Table 2–3 in Volume 1, Chapter 2 has a description of the stipulations and required operating procedures. In addition, approximately 9 million acres of the approximate 23 million acres would be classified as special areas, further protecting recreation resources in the Reserve. These lease stipulations and best management practices help protect recreation resources by protecting the natural environment and the resources that recreationists may be interested in such as fish, mammals, birds, vegetation, and water.

4.6.16.4 Conclusion

The impacts from activities not associated with oil and gas on recreation resources would be minimal, seasonal, confined to the immediate area, and present only during the activity for Alternative C. About 718,894 acres or 74,953 miles would be expected to be impacted short term by seismic activities, 432,669 acres or 144,223 miles of seasonal impacts by the construction of ice roads or airstrips and snow trails, and 1,464 acres of short-term impacts by exploration and delineation wells, as described in the oil and gas scenarios above. However, due to the remoteness and climate of the Reserve, and typical type and frequency of recreation use taking place in the winter, there would be minimal, if any, effect on recreation opportunity from these activities.

The approximate total number of acres impacting recreation from gravel pads, roads, and airstrips is 2,958,830 acres. Long-term acres impacted by drilling production, service wells and pipelines are approximately 3,671,329 acres (18,007 acres short term). These activities could displace recreationists, and thus, adversely affect their experiences and desired beneficial outcome from use of the public lands. However, the degree of the effect would depend on the actual location of the activities and their relationship to recreation opportunities. Pipelines, production activities, and associated human activity could alter the recreation setting to an industrial setting, which would interfere with recreationists' goals, and influence their opportunities, activities, experiences, and benefits.

The impacts on recreation resources would be similar for all alternatives. The biggest difference between the alternatives in relation to recreation resources is the total amount of activity that would take place under each alternative. The short-term acres impacting recreation resources are approximately 1,180,401 acres, seasonal 432,669 acres, and long-term 6,630,163 acres.

Approximately 9 million acres would be designated special areas under Alternative C, further protecting recreation resources in the Reserve. The southern portion of the NPR-A, which has traditionally had the most special recreation permit authorizations per year would not be available for leasing under Alternative A. Alternative C would have the second highest acreage use for oil and gas-related activities of all the alternatives.

As the climate gets warmer in the NPR-A (Scenarios Network for Alaska Planning 2010), the timing of recreation activities would change. Summer recreation activities could take place for a longer time period and winter activities for a shorter timeframe. Warmer and longer summers could increase the demand for recreational use of the area. Climate change could affect the caribou migration patterns, which would also change the location of guided special recreation permit activity taking place. According to the Scenarios Network for

Alaska Planning fire map, there would be an increase in fires in the southern portion of NPR-A. The fires could displace special recreation permit permittees.

4.6.17 Wild and Scenic Rivers

During scoping for this IAP, 12 streams in the NPR-A were found to meet the minimum requirements for inclusion in the National Wild and Scenic Rivers System, and to lack up-to-date evaluation of their suitability for such designation. The 12 streams, all in the southern and southwestern NPR-A and not covered by the existing Northeast and Northwest NPR-A plans, are the Nigu, Etivluk, Ipnavik, Kuna, Kiligwa, Nuka, Utukok, Awuna, upper Colville, and Kokolik rivers and Driftwood and Carbon creeks. Each of these streams has outstandingly remarkable values, which were identified during scoping by the public and the planning team as described in section 3.4.7.3 (Volume 1, Chapter 3). The outstandingly remarkable values are paleontological resources, recreation, wildlife habitat and wildlife viewing, scenery, cultural resources, and subsistence. Wild and Scenic Rivers should remain free-flowing and unpolluted.

Under Alternative C, 3 of the 12 eligible rivers described in section 3.4.8 would be found suitable and recommended for inclusion in the National Wild and Scenic Rivers System, to be managed as scenic river areas. The three streams are the Utukok River, the upper Colville River, and the Kiligwa River. The Utukok and Colville are major drainages in the southern NPR-A area, while the Kiligwa is a tributary of the Colville, with headwaters near the crest of the Brooks Range.

This alternative would have 447 miles of river corridor that would be suitable and recommended in the National Wild and Scenic River System (Table 4-20 in Volume 2). Management as a scenic river, as opposed to management as a wild river area, might make it easier to allow activities like subsistence cabins, roads, or pipelines that could be designed to protect free flow, water quality, and outstandingly remarkable values, but could still impact the primitive character of the river environment. Oil and gas leasing would be unavailable in the watershed of the upper Colville and Kaligwa. The upper section of the Utukok drainage would also be unavailable for leasing. These three river areas would have Visual Resource Management Class I buffers in the approximately 1-mile-wide river corridor area and a 10-mile-wide buffer managed as Visual Resource Management Class III. The other eligible rivers, which are not found suitable under this alternative, would have 6-mile-wide Visual Resource Management Class III buffers. The Nuka, Kuna, Ipnavik, Etivuluk, and Nigu rivers within NPR-A would be unavailable for leasing.

4.6.17.1 Activities Not Associated With Oil and Gas Exploration and Development

Free Flow and Water Quality: The 12 eligible rivers would remain free flowing and free of pollution from impacts resulting from non-oil and gas activities would be the same as described for Alternative A, because non-oil and gas activities would not change.

Outstandingly Remarkable Values: There are no notable impacts to outstandingly remarkable values identified for the 12 eligible rivers from non-oil and gas activities. Paleontological resources would continue to be studied and there is some chance that unauthorized removal of paleontological resources might occur at a similar level to the current situation. Studies impact a few square meters of surface, and resource theft, while it is known to occur, is uncommon, and law enforcement efforts in this area are thought to provide deterrence. Wildlife resources along the rivers might be disturbed to a very minor extent by recreational visitors and by aircraft. Recreational activity will likely continue at current levels. Recreational activities along the eligible rivers would not be noticeably impacted by other non-oil and gas activities in the area. Subsistence resources and access would not be impacted by non-oil and gas activities along the eligible streams. Scenery in the area would not be changed by non-oil and gas activities.

4.6.17.2 Oil and Gas Exploration and Development Activities

There would be few, if any, direct or indirect impacts to the Wild and Scenic River values of the 12 eligible rivers under Alternative C from oil and gas exploration and development activities. The eligible river area most likely to be impacted is the Utukok, which would be recommended for designation and management as a scenic river area. Although all but the upper portion of the Utukok would be available for leasing (see Table 4-20 in Volume 2) under Alternative C, the outstandingly remarkable values of the Utukok would be protected by designation. The upper Colville and Kiligwa rivers would be similarly protected, and in addition, they would be unavailable for leasing and non-subsistence permanent infrastructure would be prohibited.

The Kokolik and Awuna rivers and Carbon Creek would be available for leasing. Carbon Creek, the middle portion of the Utukok River, and the upper portions of the Kokolik and Awuna rivers within the NPR-A would receive protection under stipulation K-12. Adverse impacts to free flow, water quality, and outstandingly remarkable values for these three streams would be somewhat more likely than under Alternative A, although the potential for development activities, including roads and pipelines in these areas are low.

Aircraft overflights of eligible rivers might increase from oil and gas activities, and if this happens, there would be some impact to recreation and subsistence. Recreation experiences would be less primitive, and subsistence hunts could be disrupted by such overflights.

In Alternative C, 3 rivers are proposed for designation as Scenic River Areas. The BLM manual (MS-6400 7.1) states that in scenic river areas:

> New roads and railroads are permitted to parallel the river for short segments or bridge the river if such construction fully protects river values (including the river's free-flowing condition). Bridge crossings and river access are allowed. New trail construction or airfields must be compatible with and fully protect identified values.

While under Alternative B-1 road crossings of Wild and Scenic Rivers could be largely precluded and powerlines or aboveground pipelines might be difficult to approve, under Alternative C, designation of the 3 rivers as scenic river areas would pose less of a challenge for proponents of pipelines, roads, powerlines, or other transportation systems.

4.6.17.3 Effectiveness of Stipulations and Required Operating Procedures

Required Operating Procedures A-2 through A-7 reduce risks to water quality impairment through procedures for handling potential pollutants, preventing spills, and responding to spills. Setbacks in K-1 should be effective in reducing potential pollution and visual impacts to all eligible streams. In addition, Best Management Practice C-2 would protect stream banks from compaction and E-16 would prohibit removal of more than 100 cubic yards of sand or gravel from cliffs, and any extraction of sand or gravel near streams would require studies that would indicate there would be no potential impacts to the integrity of the river bluffs. Stipulation K-12 would provide protection for the wildlife values (caribou) near four eligible rivers north of the area in which no leasing or permanent non-subsistence infrastructure would be permitted.

4.6.17.4 Conclusion

There would be few, if any, direct or indirect impacts to the Wild and Scenic River values of the 12 eligible rivers under Alternative C. The eligible river area most likely to be impacted is the Utukok, which would be recommended for designation and management as a scenic river area. Although most of the Utukok would be available for leasing (see Table 4-20 in Volume 2) under Alternative C, the outstandingly remarkable values of the Utukok would be protected by designation. The upper Colville, the uppermost part of the Utukok, and the Kiligwa rivers would be similarly protected, and in addition, they would be unavailable for leasing and permanent non-subsistence infrastructure would be prohibited.

The Kokolik and Awuna rivers and Carbon Creek would be available for leasing. Carbon Creek, the middle part of the Utukok, and the upper portions of the Kokolik and Awuna rivers within the NPR-A would receive protection under K-12. Adverse impacts to free flow, water quality, and outstandingly remarkable values for these three streams would be somewhat more likely than under Alternative A, although the potential for development activities, including roads and pipelines in these areas, are low.

All eligible rivers would be subject to stipulations and required operating procedures, including Required Operating Procedures A-2 through A-7, and K-1, which would reduce the potential for pollution and visual impacts. Values would be protected by stipulations and best practices and because development or installation of infrastructure in these river areas is largely prohibited, and oil and gas potential is low throughout the southern area. There would be no impacts to Wild and Scenic River values of eligible rivers within the planning area as direct or indirect impacts of this alternative. Eligibility for inclusion in the National Wild and Scenic Rivers System in the future through impacts to free flow, water quality, or outstandingly remarkable values would not be foreclosed.

Climate change might impact the vegetation and soils along the eligible streams, most noticeably by the intrusion of taller shrubs and thawing permafrost. This would impact the accessibility and scientific values of cultural sites by hiding them, and change the scenic quality of the areas viewable from the stream by limiting vistas. It is possible that melting permafrost could increase sedimentation and turbidity in these streams, reducing water quality.

4.6.18 Wilderness Characteristics

Alternative C would allow leases to be offered for oil and gas exploration and development on 76 percent of NPR-A subsurface lands. Another 1.57 million acres would remain deferred from oil and gas leasing until 2014; and 425,000 deferred until 2018. There are 9 million acres that would be recognized as special areas (Teshekpuk Lake Special Area, Colville River Special Area, Utukok River Uplands Special Area, Kasegaluk Lagoon Special

Area, and Peard Bay Special Area). Alternative C would recommend three rivers be designated as Wild and Scenic Rivers.

4.6.18.1 Activities Not Associated with Oil and Gas Exploration and Development

Under Alternative C, the characteristics of wilderness would be affected in the same way as Alternative A from activities not associated with oil and gas exploration and development. Alternative C provides for smaller additions to Special Areas than Alternatives B-1 and B-2 and makes unavailable for leasing the most remote part of NPR-A which has the greatest potential for providing a primitive recreation experience. These would not change the effects of activities not associated with oil and gas as compared to Alternative A.

4.6.18.2 Oil and Gas Exploration and Development Activities

Seismic Surveys

Under Alternative C there could be an estimated up to 14 seismic surveys, 6 exploration-focused and 8 production-focused, for a total estimated short-term disturbance of 718,900 acres (see Table 4-11 in Volume 2) for surveying and camp train use under Alternative C. The surveys use low-ground-pressure vehicles to minimize potential impacts to the tundra. The typical survey lasts about 100 days. Seismic camps, which generally consist of six camp strings of five ski-mounted trailers, are typically moved every few days to once a week. Wilderness characteristics could be minimally impacted from the moving camps and associated noise from generators, aircraft, and human presence. The impact would be minimal, temporary, and confined to the immediate area (i.e., within approximately 0.5 mile in any direction).

A longer lasting impact could be to vegetation resulting from seismic survey operations (see section 4.6.5) impacting naturalness and scenic values. The color contrast would be minimal from ground view and almost nonexistent from more than a few hundred feet away. After 8 to 9 years, the evidence of use would be minimal. Seismic operations by their nature do not follow the same routes every year and the number of miles of survey line run can vary greatly from year to year.

Ice Roads, Pads, Airstrips and Snow Trails

Ice roads, pads, airstrips, and snow trails are temporary in nature and traversed during the winter months. Ice roads provide seasonal routes for heavy equipment supplies, and movement of personnel to remote staging areas or well locations. Ice air strips are used to transport crews and supplies to and from sites. Snow trails provide seasonal routes for use by low-ground-pressure vehicles and used for moving equipment, supplies, personnel accommodations, and drill rigs capable of disassembly to components small enough for transport on such vehicles. The estimated total seasonal acres disturbed by ice roads, ice pads, airstrips, and snow trails are 432,669 acres. The wilderness characteristics of naturalness, outstanding opportunities for solitude or primitive and unconfined recreation could be minimally impacted from the associated noise from generators, aircraft, and human presence. The impact would be minimal, temporary, and confined to the immediate area (i.e., within approximately 0.5 mile in any direction).

Exploration and Delineation Wells

Exploration drilling since 1999 involved no more than two drill rigs active simultaneously in the Reserve in any given season. The estimated number of drill rigs per year under Alternative C for exploration/delineation is three oil rigs and four gas rigs. While a rig could be used for multiple wells each rig could only be used at one site at a time. Typically, drill rigs are removed from the Reserve at the end of the winter drilling season. Drilled wells are either plugged or capped for reentry at a later date. The wilderness characteristics of naturalness and outstanding opportunities for solitude or primitive and unconfined recreation could be minimally impacted from the associated noise from generators, vehicles, and human presence. Approximately 1,464 acres would have short-term disturbance from exploration and delineation wells under Alternative C. The impact would be minimal, temporary, and confined to the immediate area (i.e., within approximately 0.5 mile in any direction). For well sites that are capped, a wellhead would remain on site. Due to the remoteness and expansiveness of the Reserve a capped well head would not impact wilderness characteristics.

Gravel Pads, Roads, and Airstrips

As part of production activities an airstrip, camp facilities, and a storage yard would be needed. A borrow site from which to acquire gravel for pads, roads, and an airstrip may be a part of each production operation, but depending on the availability of gravel and the proximity of production operations, some borrow sites may provide gravel for multiple production operations. The only visible disturbance associated with gravel sites from borrow pits would generally only be stockpiled material. While these sites could be large in size or footprint (about 37 acres each), very little material would remain as stockpile at any one time. Gravel mine sites from aboveground bedrock locations may produce visual impacts if material is removed from rock outcrops within the planning area. Airstrips would usually be located near a central processing facility for transport of supplies and personnel to the field site.

While the intensity of impacts would be greatest during actual construction and development of these facilities, remaining structures (i.e., roads, pads, airstrips), human presence, and associated activity and noise all would have impacts on wilderness characteristics during the life of the activity. Because production could occur for 10 to 50 years beyond the development phase, impacts to wilderness characteristics of naturalness, outstanding opportunities for solitude or primitive and unconfined recreation, and scenic supplemental values would be long term. These impacts would be greatest within1 mile of a site. The estimated usage for in-field gravel roads, airstrips, gravel pads, and gravel pits in Alternative C is 10,831 acres. The estimated long-term disturbance for central processing facilities, booster pump stations, compressor stations and staging bases in Alternative C is 765 acres. The greatest impacts to wilderness characteristics would be within 2 miles of one of these sites.

At this time, it is not known what the layout of this infrastructure would be. Assuming all roads, pads, pits, and airstrips do not overlap with other infrastructure; a 1-mile impact zone for roads, airstrips, and gravel pits; a 2-mile impact zone for pads and associated facilities; the approximate total number of acres impacting wilderness characteristics by these features is 3,152,395 acres. The BLM can require removal of gravel roads/pads/airstrips after the life of the activity, or could decide to allow them to remain forever, which would have a permanent impact on wilderness character. If these activities impair wilderness characteristics in the future, the areas would be excluded from the inventory of lands with wilderness characteristics.

The discovery and development of commercial fields is likely to occur gradually across the NPR-A. During production there would be a production pad, which could potentially support dozens of wells and contain a large central processing facility for an oil field or a combined central processing facility/gas compressor facility for a gas field.

The central processing facility would typically include living quarters and offices, maintenance shops, storage tanks for fuel and water, power generators, waste-treatment units, a communications center, communication towers, aircraft towers, and compressors for gas and water reinjection. They would be constructed as transportable modules, which would be supported above the ground on pilings to accommodate ground settling or frost heaving. Communication towers could be as high as 200 feet and well lit.

Pipelines

The production operation would include feeder lines, regional pipelines, booster pump (oil) or additional compression stations (gas), a high pressure gas trunk line, a gas conditioning facility and an a oil-sale and/or gas-sale pipeline to transport the resource to market. The actual locations of new pipelines in the NPR-A would depend on the location and sequence of commercial-sized discoveries. Aboveground pipelines for oil would be the preferred method while gas pipelines would be underground. Because production could occur for 10 to 50 years beyond the development phase, impacts to wilderness characteristics of naturalness, outstanding opportunities for solitude or primitive and unconfined recreation, and scenic supplemental values would be long term. The estimated long-term usage for gathering/feeder lines, gas pipelines and oil pipelines in Alternative C is 3,720 acres, with 15,778 acres short-term use. Short-term impacts would be minimal, temporary, and confined to the immediate area (i.e., within approximately 0.5 mile in any direction). Assuming a 1-mile impact zone on either side of pipelines, the total long-term impacts to wilderness characteristics from oil and gas pipelines would be approximately 3,477,760 acres. If these activities impair wilderness characteristics in the future, the areas would be excluded from the inventory of lands with wilderness characteristics.

4.6.18.3 Effectiveness of Stipulations and Best Management Practices

Although the lease stipulations and best management practices do not specifically address wilderness characteristics and the BLM is not considering recommending designation of wilderness in the planning area, many of the standards required for development of Alternative C would serve to protect wilderness characteristics including best management practices A-1 through A-7, B-2, C-2, C-3, E-1, E-4, E-13, and F-1,and lease stipulations D-1, D-2, and G-1. In addition, approximately 9 million acres would be classified as Special Areas, further protecting wilderness characteristics in the Reserve. Table 2–3 in Volume 1, Chapter 2 has a description of the stipulations and required operating procedures/best management practices. These lease stipulations and best management practices help protect wilderness characteristics by protecting the natural environment and resources such as fish, mammals, birds, vegetation, and water.

4.6.18.4 Conclusion

The impacts from activities not associated with oil and gas on wilderness characteristics from Alternative C would be minimal, confined to the immediate area, and for the most part, concurrent with activities. Total short-term acres for Alternative C as described in the oil and gas scenarios for seismic activities would be approximately 1,180,401 acres. However, there may be evidence of the seismic activity for 8 to 9 years. About 432,669 acres would be expected to be disturbed by the construction of ice roads, ice pads, airstrips, and snow trails, and 1,416 acres by exploration and delineation wells as described in the oil and gas scenarios above. The impact would be minimal, temporary, and confined to the immediate area.

The approximate total number of acres impacting wilderness characteristics from gravel pads, roads, and airstrips is 2,958,830 acres. Long-term acres impacted by drilling production, service wells and pipelines are approximately 3,671,329 acres (18,007 acres in the short term). If these activities impair wilderness characteristics in the future, the areas would be excluded from the inventory of lands with wilderness characteristics.

Disturbance from long-term, seasonal and short-term actions could potentially impact approximately 8.2 million of the NPR-A's nearly 23 million acres in a manner that could impair wilderness characteristics. Of the remaining 14.8 million acres in the NPR-A, 9 million acres of lands with wilderness characteristics would be protected by special designation or by being unavailable for leasing and development. The balance of the lands with wilderness characteristics, 5.8 million acres, would not have measures taken to specifically protect lands with wilderness characteristics, but are not anticipated to be subject to actions that would cause wilderness characteristics to be lost.

The impacts on wilderness characteristics would be similar for all alternatives. The biggest difference between the alternatives in relation to wilderness characteristics is the total amount of activity that would take place under each alternative. Alternative C would have the second highest acreage use for oil and gas related activities of all the alternatives.

The supplemental values than an area may contain of ecological, geological, or other features of scientific, education, scenic, or historical value may be affected if the climate continues to warm in the NPR-A (Scenarios Network for Alaska Planning 2010). See climate sections within the Physical Environment and Biological Resources sections of Chapter 3 for more information.

4.6.19 Visual Resources

Under Alternative C, a corridor extending approximately a 0.5 mile from the bank of three rivers recommended for designation as a Wild and Scenic Rivers would be designated Visual Resource Management Class I (1 percent of NPR-A; Map 2-5). The objective of this class is to preserve or retain the existing character of the landscape. Rivers and lands within 3 miles of segments of rivers identified as eligible for Wild and Scenic River designation in this IPA, the 2003 Northwest NPR-A IAP, or the 2008 Northeast NPR-A SIAP; also Kasegaluk Lagoon, Peard Bay, Elson Lagoon, Dease Inlet, and Admiralty Bay and lands within 3 miles of those waterbodies would be designated Visual Resource Management Class III. This class would generally allow change to occur (33 percent of

NPR-A). The rest of the NRP-A would be Class IV. The levels of change allowed for this class can be high (65 percent of NPR-A).

4.6.19.1 Activities Not Associated with Oil and Gas Exploration and Development

Under Alternative C, visual resources could be affected in the same way as Alternative A from activities not associated with oil and gas exploration and development. Alternative C provides for smaller additions to Special Areas than Alternative B-1 and B-2 and makes unavailable for leasing the most remote part of NPR-A, neither of which would change the effects of activities not associated with oil and gas from Alternative A.

4.6.19.2 Oil and Gas Exploration and Development Activities

Seismic Surveys

Under Alternative C, there could be up to 14 seismic surveys, 6 exploration-focused and 8 production-focused, under Alternative C for a total of estimated 718,900 acres by surveying and camp train use. The surveys use low-ground-pressure vehicles to minimize potential impacts to the tundra. The typical survey lasts about 100 days. Seismic camps, which generally consist of six camp strings of five ski-mounted trailers, are typically moved every few days to once a week.

On-shore seismic surveys on the North Slope are only collected in the winter; therefore, the colors of structures and equipment would have a weak contrast with the white color of the snow-covered landscape. Activities in the winter would be far less visible due to the limited daylight hours, although lights on equipment would be visible when the equipment is passing through an area. Due to the remoteness and climate of the Reserve, the casual observer would not likely be present to be affected visually by the seismic activity. Local subsistence users could be traveling on the tundra and observe the seismic activity (see section 4.6.13). Visual resources could be minimally impacted from the moving camps, aircraft, and human presence.

The seismic operations would have a moderate contrast to the landscape character element of line. In Visual Resource Management terms, the definition of moderate is: "The element contrast begins to attract attention and begins to dominate the characteristic landscape" (H-8431-1). The seismic equipment would represent a bold line on a large mass of continuous white.

A longer lasting visual impact could be to vegetation resulting from seismic survey operations (see section 4.6.5). Because trails visually modify existing vegetation, they would not produce much contrast to line, form, or texture. The color contrast would be minimal from ground view and almost nonexistent from more than a few hundred feet away. After 8 to 9 years, the evidence of use would be minimal. Seismic operations by their nature do not follow the same routes every year and the number of miles of survey line run can vary greatly from year to year.

Ice Roads, Pads, Airstrips, and Snow Trails

Ice roads, pads, airstrips, and snow trails are temporary in nature and traversed during the winter months. Ice roads provide seasonal routes for heavy equipment supplies, and personnel accommodations moving to remote staging areas or well locations. Ice airstrips are used to transport crews and supplies to and from sites. Snow trails provide seasonal routes for use by low-ground-pressure vehicles and are used for moving equipment, supplies, personnel accommodations, and drill rigs capable of disassembly to components small enough for transport on such vehicles.

Activities in the winter would be far less visible due to the limited daylight hours, although lights on equipment would be visible when the equipment is passing through an area. Due to the remoteness and climate of the Reserve, the casual observer would not likely be present to be affected visually by this activity. Local subsistence users could be traveling on the tundra and observe the activity (see section 4.6.13). Visual resources could be minimally impacted from the moving camps, aircraft, and human presence. The estimated total seasonal acres impacted by ice roads, ice pads, airstrips, and snow trails are 432,669 acres.

Exploration and Delineation Wells

Exploration and delineation wells are typically drilled in the winter in the Reserve. Exploration drilling since 1999 involved no more than two drill rigs active simultaneously in the Reserve in any given season. The estimated number of drill rigs per year under Alternative C for exploration/delineation is three oil rigs and four gas rigs. While a rig could be used for multiple wells, each rig could only be used at one site at a time. Typically, drill rigs are removed from the Reserve at the end of the winter drilling season. Drilled wells are either plugged or capped for reentry at a later date. Capped wells have a pipe, which would likely be less than 6 feet tall and encased by a short fence 6 foot square. The pipe could be a long-term impact, but would be almost unnoticeable from several hundred feet away. Approximately, 1,464 acres would have short-term impacts from exploration and delineation wells under Alternative C.

Activities in the winter would be far less visible due to the limited daylight hours, although lights on equipment would be visible when the equipment is passing through an area. Due to the remoteness and climate of the Reserve the casual observer would not likely be present to be affected visually by this activity. Local subsistence users could be traveling on the tundra and observe the activity (see section 4.6.13). Visual resources could be minimally impacted from the moving camps, aircraft, and human presence.

Gravel Pads, Roads, and Airstrips

As part of production activities, an airstrip, roads, camp facilities, and a storage yard would be needed. A borrow site from which to acquire gravel for pads, roads, and an airstrip may be a part of each production operation, but depending on the availability of gravel and the proximity of production operations, some borrow sites may provide gravel for multiple production operations. The only visible disturbance associated with gravel sites from borrow pits would generally only be stockpiled materials. While these sites could be large in size or footprint (about 37 acres each), very little material would remain as stockpile at any one time. Gravel mine sites in the NPR-A from aboveground bedrock locations may produce visual impacts if material is removed from rock outcrops. This mining activity would change the form of the natural landscape and may be visible from the Foreground-Middleground Zone. Airstrips would usually be located near a central processing facility for transport of supplies and personnel to the field site.

While the intensity of impacts would be greatest during actual construction and development of the roads and pads, human presence and associated activity could also have impacts on visual resources during the life of the activity. The landscape of the Reserve is homogeneous, with little visual variety and contrast. Therefore, building a road would be expected to cause a weak amount of contrast to the form of the land. In Visual Resource Management terms, the definition of weak is: The element contrast can be seen, but does not attract attention (H-8431-1). It would minimally impact the landscape character element of line through introduction of the location and road, both of which would be visible linear features. Exposing the soil would cause a weak impact to the color in the landscape. The texture of the exposed soil would be smoother than the existing landscape, thus creating a weak contrast. When an application is received for a road, a visual contrast rating would be completed to determine the actual contrast, along with a visual simulation and mitigation measures would be determined to maintain the appropriate Visual Resource Management class.

Because production could occur for 10 to 50 years beyond the development phase, impacts would be long term. These impacts would be greatest within 1 mile of a site. The estimated disturbance for in-field gravel roads, airstrips, gravel pads, and gravel pits in Alternative C is 10,831 acres. The estimated long-term use for central processing facilities, booster pump stations, compressor stations and staging bases in Alternative C is 765 acres. The greatest impacts to visual resources would be within 2 miles of one of these sites. At this time, it is not known what the layout of this infrastructure would be. Assuming all roads, pads, pits, and airstrips do not overlap with other infrastructure; a 1-mile impact zone for roads, airstrips, and gravel pits; a 2-mile impact zone for pads and associated facilities; about 3,152,395 acres would be impacted. The relative proportion of the roads, airstrips, and pads to the Reserve size is minimal. Once built, they would be used year-round. Due to the climate of the Reserve, the casual observer would be more likely to see the roads in the summer than winter. The impact associated with the graveled pads and roads would be moderate long term, and confined to the 1- and 2-mile impact zones.

The discovery and development of commercial fields is likely to occur gradually across the NPR-A. During production, there would be a production pad, which could potentially support dozens of wells and contain a large central processing facility for an oil field or a combined central processing facility/gas compressor facility for a gas field.

The central processing facility would typically include living quarters and offices, maintenance shops, storage tanks for fuel and water, power generators, waste-treatment units, a communications center, communication towers, aircraft towers, and compressors for gas and water reinjection. They would be constructed as transportable modules, which would be supported above the ground on pilings to accommodate ground settling or frost heaving. Communication towers could be as high as 200 feet and well lit.

The blocky, rectangular form of the structures would contrast strongly with the existing landscape. They would introduce distinct vertical lines that would strongly contrast with the existing horizontal landscape. In Visual Resource Management terms, the definition of strongly is: "The element contrast demands attention, will not be overlooked, and is dominant in the landscape" (H-8431-1). The smooth texture of the structures would strongly contrast with the coarser texture of the surrounding vegetation. Potential impacts would include artificial light and associated sky glow from winter drilling. This lighting would degrade scenic quality by introducing intrusive, artificial lighting into an otherwise unlit natural landscape that would be visible from a distance of approximately 17 miles (based on a 200-foot tower, calculated mathematically).

Visual resources would be moderately impacted long term, and confined to the area of view. The actual effects would depend greatly on where development fields were located.

Pipelines

The production operation would include feeder lines, regional pipelines, booster pump (oil) or additional compression stations (gas), a high-pressure gas trunk line, a gas conditioning facility and an oil-sale and/or gas-sale pipeline to transport the resource to market. The actual locations of new pipelines in the NPR-A would depend on the location and sequence of commercial-sized discoveries. Aboveground pipelines for oil would be the preferred method while gas pipelines would be underground.

Building a pipeline would cause a strong amount of contrast to the form of the land. It would moderately impact the landscape character element of line through introduction of the location and pipeline, both of which would be visible linear features. Exposing the soil would cause a weak impact to the color in the landscape. The texture of the exposed soil would be smoother than the existing landscape, thus creating a weak contrast. Once the pipeline is built it would have a moderate contrast with the form of the land. The NPR-A has many lakes of various sizes and shapes. A pipeline crossing the lakes would create a moderate contrast. The color contrast would depend on the color of the pipeline. Assuming the pipeline is grayish silver, there could be a moderate contrast with the colors in the landscape. The texture of the pipeline would be smooth compared to the existing landscape.

Once built, a pipeline would have a long-term impact on the area, being more visible in the summer months than the winter months. The estimated long-term disturbance for gathering/feeder lines, gas pipelines, and oil pipelines in Alternative C is 3,720 acres, 15,778 acres in the short term. Assuming a 1-mile impact zone on either side of pipelines the total long-term impacts to visual resources from oil and gas pipelines would be approximately 3,477,760 acres.

4.6.19.3 Effectiveness of Stipulations and Best Management Practices

Although the lease stipulations and best management practices do not specifically address visual resources, many of the standards required for development of Alternative C would serve to protect visual resources including best management practices A-1through A-7, C-2, C-3, E-1, E-5, and E-15, and lease stipulations D-1, D-2, and G-1, by regulating overland moves, seismic work, exploratory drilling, facility design, construction and siting of facilities, water use, minimize impacts to solid and hazardous waste, minimize contaminants and the protection of stream banks. In addition, approximately 9 million acres would be classified as special areas, further protecting visual resources in the Reserve. Table 2–3 in Chapter 2, Volume 1, has a description of the stipulations and best management practices. These lease stipulations and best management practices help protect visual resources by protecting the natural environment and resources such as fish, mammals, birds, vegetation, and water.

4.6.19.4 Conclusion

The impacts from activities not associated with oil and gas on visual resources would be minimal, confined to the immediate area, and for the most part concurrent with activities. Total short-term acres for Alternative C as described in the oil and gas scenarios for seismic activities would be approximately 1,180,401 acres. However, there may be evidence of the seismic activity for 8 to 9 years. About 432,669 acres would be expected to be disturbed by the construction of ice roads, ice pads, airstrips, and snow trails, and 1, 416acres by exploration and delineation wells as described in the oil and gas scenarios above. The impact would be minimal, temporary, and confined to the immediate area.

The approximate total number of acres impacting visual resources from gravel pads, roads, and airstrips is 2,958,830 acres. Long-term acres impacted by drilling production, service wells and pipelines are approximately 3,671,760 acres, 15,778 acres in the short term. The impact to visual resources from gravel pads, roads and drilling production, service wells and pipelines would be moderate long term, and confined to the 1- and 2-mile impact zones. When an application is received for these kinds of activities a visual simulation would be conducted for the NEPA analysis for each project, which would determine the actual impact expected, along with a visual contrast rating form.

Climate change could affect visual resource values by altering the current conditions of color, vegetation, adjacent scenery, and the presence of water. Shifts in public sensitivity could shift as well. The biggest difference between the alternatives is the total amount of activity that affects visual resources, because all the alternatives would have similar types of impacts. Disturbance from long-term, seasonal, and short-term actions could potentially impact approximately 5.4 million of the NPR-A's nearly 23 million acres in a manner that could impact visual resources. Approximately 9 million acres would be included in Special Areas under Alternative C, further protecting visual resources in the Reserve. Alternative C would have the second highest acreage use of all the alternatives. The acres impacted with this alternative are more than Alternatives A, B-1, and B-2, but less than Alternative D. The Visual Resource Management classes determined in Alternative C would create more lands in Class I, less Class II, less Class III, and more Class IV than the visual resource inventory. Table 4-21 in Volume 2 provides a comparative analysis between the percent of the acres of inventory class versus the percent of the acres of Visual Resource Management classes.

4.6.19.5 Potential Mitigation Measure (New Best Management Practice)

The objective and requirement/standard would be the same as those described in section 4.3.19.5 in Volume 2. The potential benefits and residual/unavoidable impacts would be similar to those described for Alternative A at section 4.3.19.5 in Volume 2, yet within the context of the different Visual Resource Management classes designated in this alternative.

4.6.20 Economy

4.6.20.1 Activities Not Associated with Oil and Gas Exploration and Development

Impacts of non-oil and gas activities are likely to be the same as those for Alternatives A, B-1, and B-2. The BLM estimates up to 6 to 12 trips, each with 10 to 12 persons, would take place each year (see Table 4-1 in Volume 2). Employment is expected to remain the same as in Alternatives A, B-1, and B-2. Permitted commercial guided activities will result in fees to the federal government. These are estimated to total at least $600 per year for special recreation permits.

Other activities such as research or surveys, various ground activities, and aircraft use not related to petroleum are shown in Table 4-1 in Volume 2 and are expected to be similar to Alternatives A, B-1, and B-2. North Slope Borough residents may be employed in some of these activities, as will other Alaskans and non-residents.

4.6.20.2 Oil and Gas Exploration and Development Activities

In Alternative C, activities will begin and proceed in a manner and order similar to Alternative A. Discovered resources will remain the same. For undiscovered resources, peak production in this alternative is calculated at 72 thousand barrels of oil per day for oil and 2.42 billion cubic feet per day for gas. This requires 11 oil and 38 gas processing facilities. Oil production will contribute to maintain the Trans-Alaska Pipeline System throughput above threshold for more than four years at peak production, assuming a 270,000 barrels per day threshold and a six percent production decline rate.

Revenues

Revenues under this alternative are higher than under Alternatives A, B-1, or B-2. Bonus bids are expected to total $179 million and average $6 million over a 30-year term. Exploration, development, and production activities for the undiscovered resources are estimated to generate property tax revenue to the North Slope Borough of about $5 billion over the period. Other local, state, and federal revenues are also anticipated to increase under this alternative. Estimated royalty payments of $17 billion will be shared equally by the State of Alaska and the federal government. State corporation taxes will be nearly $1.6 billion, and federal income tax will be nearly $13.6 billion. In addition, state production taxes are estimated to be $5.4 billion. These estimates are based upon prices of $180 per barrel of oil and $8.67 per thousand cubic feet of gas as explained in section 4.2.1 in Volume 2.

Total revenue data including discovered and undiscovered resources are presented in Table 4-29. Local, State, and federal government revenues total $55 billion for all the activities, and would average $2 billion if all activities occur simultaneously.

Employment

In this alternative, employment for the discovered resources will remain as described in Alternative A. Employment for the undiscovered resources will be similar to Alternative A, but will reflect slightly higher activity. Oil processing facilities will remain at 11, but the number of gas processing facilities will increase to 38. Other infrastructure will also increase. Resulting new or continued employment is presented in Table 4-30.

Table 4-29. Alternative C revenues (in millions of 2010 dollars)

	North Slope Borough		State of Alaska		Federal	
	Total	Average annual*	Total	Average annual*	Total	Average annual*
Bonus bids**			90	3	90	3
Royalty			10,744	399.5	10,744	399.5
Property tax	5,392	201.0	599	22.0		
Corporate income tax			1,926	71.0	16,176	595.0
Production tax			9,512	344.0		
Totals	**5,392**	**201.0**	**22,871**	**839.5**	**27,010**	**997.5**

* If all projects occur simultaneously.
** Over next 30 years.

Table 4-30. Potential employment under Alternative C

	Alternative total	Annual average
Total for all places of residence	548,191	14,829
Direct	227,380	6,060
Indirect & Induced	320,811	8,769
North Slope Borough total	21,786	636
Direct	11,828	344
Indirect & Induced	9,958	292
Other Alaska total	429,755	11,582
Direct	158,708	4,201
Indirect & Induced	271,047	7,381
Outside Alaska total	96,993	2,611
Direct	56,846	1,515
Indirect & Induced	40,147	1,096

Other Effects of Oil and Gas Development

Under Alternative C, if health problems arise due to air or water pollution or other causes as described in section 3.4.12, "Public Health" in Volume 1, there would be increased economic costs both for individuals and government associated with concerns such as health care, social services, and law enforcement. Because more development is anticipated under this alternative, it is possible that these economic costs will be higher than under Alternatives A, B-1, and B-2, but lower than Alternative D.

Development under Alternative C could also contribute to some increase in the cost of engaging in subsistence activities. Costs would include fuel, supplies, equipment, and additional time, particularly as travel is increased. These costs may be higher than at the level of development in Alternatives A, B-1, and B-2, but less than Alternative D. Increased local employment may temper the overall effect of increased costs.

Alternative C is not likely to affect the cost of fuel or supplies to villages resulting from operation of ice roads. The chief executive officer of Kuukpik Corporation stated he could not see changes in economies resulting from the operation of ice roads (Chinn 2007). Unless there is a gravel road connecting Nuiqsut or other North Slope villages to the state's road network, which is not anticipated as part of this IAP/EIS, it is unlikely that costs would change significantly.

With the possible exception of services related to health, social services, and law enforcement noted above, public infrastructure costs, including schools and local airports, are not likely to be affected by development under Alternative C. North Slope oil fields are largely self-sufficient for emergency services and health and social services. For example, oil facilities typically include emergency medical technicians, clinical facilities, and emergency transportation. Air traffic from oil and gas development will be directed toward oil field airstrips, not community airports. Local government revenues will be larger under this alternative than under Alternative A, B-1, and B-2, so some additional services or infrastructure may be supported during the life of the development, and possibly beyond.

4.6.20.3 Conclusion

The revenues and employment generated by oil and gas exploration and development under Alternative C would be greater than under Alternatives B-1 or B-2 and slighter greater than under Alternative A, but less than under Alternative D. Oil and gas exploration and development would benefit the local, state, and national economy by increasing revenues and employment. Over $55 billion would flow to all levels of government. There would be $27 billion for the federal government, $22.9 billion for the State of Alaska and $5.4 billion for the North Slope Borough. The number of jobs created by exploration, development, and production would total 548,191 direct and indirect over the life of all projects. An average of 636 North Slope Borough resident jobs would be added or continued if discovered and undiscovered resources were developed simultaneously. Increased costs to harvest subsistence resources could affect the economic well-being of North Slope Borough residents, primarily through increased costs to reach subsistence resources.

4.6.21 Public Health

4.6.21.1 Activities Not Associated with Oil and Gas Exploration and Development

The activities not associated with oil and gas exploration and development are described in section 4.2.1.1 in Volume 2, and include aircraft use, river trips and other recreational uses, site cleanup and remediation activities, overland moves, archeological surveys and site work. The level of such activity will be the same under Alternative C as it is under Alternative A.

Such activities should not have a significant impact on public health. Localized impacts on subsistence are likely, primarily as a result of displacement of animals due to aircraft noise. In addition, the presence of temporary camps may affect subsistence, regardless of whether these cause displacement of animals, as a result of the avoidance of the area by hunters seeking to minimize conflict. These impacts are described in section 4.6.13. The effect of such activities is likely to be localized and temporary.

Alterations in the success of subsistence activities can impact health by way of nutritional outcomes and risk of injury. The mechanisms of these effects are described in section 4.3.21.2 in Volume 2. For any individual affected, the impact of an unsuccessful hunt or an accident or injury on the land could be severe. However, given the transient and highly localized nature of these activities, it is unlikely that they will have any overall impact on public health.

4.6.21.2 Oil and Gas Exploration and Development Activities

This oil and gas exploration activities described in section 4.2.1.2 in Volume 2 may lead to alterations in public health and safety via a number of different pathways. These include: diet and nutrition; environmental exposures; infectious disease; safety; acculturative stress; economic impacts; and capacity of local health care services. For details of these pathways and a description of how they impact health, see section 4.3.21.2 in Volume 2. The potential impacts of Alternative C on each pathway are described below.

Diet and Nutrition

The likelihood of impacts to subsistence harvests under Alternative C is discussed in section 4.6.13. As is the case with Alternative A, Nuiqsut, Atqasuk, and Barrow would be the most impacted communities, as these villages obtain most of their non-marine traditional food from the affected lands. Wainwright and Anaktuvuk Pass will be affected to a lesser degree, as they depend somewhat on fish and caribou harvested from potentially affected areas within the NPR-A. Any reductions in the success of the harvests of these species in any village would accelerate the transition from subsistence resources to store-bought foods, worsening nutritional outcomes and food insecurity. Partial protections of special areas of surface resources under Alternative C, including the preclusion of production pads in the Teshekpuk Lake area, protection of calving and insect-relief area for the Western Arctic caribou herd and designation of the Colville River, will help protect subsistence activity and will reduce the likelihood and severity of health impacts resulting from changes in diet and nutrition.

Nuiqsut hunters, who already avoid large areas of traditional land to the northeast of the village, could experience further limitation in their access to lands to the south and west of the village if intensive oil and gas development occurs there. Avoidance of productive land may reduce harvests and exacerbate dietary and nutritional outcomes independent of any direct impact on the animals themselves. Under Alternative C, Nuiqsut hunters will become dependent on a limited land base for subsistence activity and will be more vulnerable to fluctuations in the success of harvests.

Environmental Exposures

Health effects from environmental exposures under Alternative C will follow the same pathways as for Alternative A, described in section 4.3.21 in Volume 2. The overall impact of air quality on human health is likely to remain low. However, people who are particularly vulnerable to respiratory problems (such as children, the elderly, and people with certain chronic illnesses) may experience health problems at locations or during episodes with poorer air quality. Water contamination from runoff, spills, or discharges is unlikely to cause health effects under Alternative C. However, if water contamination reaches a drinking water supply for residences or people on the land, acute or chronic health effects may ensue, depending on the nature of the contaminant and the level and duration of exposure. In absence of a major accidental release, contaminant levels in traditional foods are likely to remain below levels that would trigger public health concern. Environmental noise may cause annoyance or sleep disturbance for those who experience it; this is most likely to be people on the land or in cabins who are affected by helicopter traffic or overflights.

Insofar as Alternative C limits conflict between subsistence and industrial uses of the land, both real and perceived environmental exposures are likely to be location-dependent. Intermittent exposure is possible in wide areas of the NPR-A where development and subsistence use overlap. Permanent facilities in close proximity to villages or cabins may episodically affect air quality, and are likely to undermine confidence in the safety of traditional foods.

Infectious Disease

Under Alternative C, as with Alternative A, a continued in-migration of oil industry workers from communities outside of the North Slope will present a risk of infectious disease transmission. The character and extent of this impact will be the same for all alternatives, varying only to the degree to which individual project characteristics increase the number of outside workers and the degree to which they fraternize with the local population. The nature of this impact is described in section 4.6.21.2.

Safety

As with Alternative A, under Alternative C, the main impact on safety will result from local alterations in travel patterns for subsistence activity. Noise from overflights in any area of exploration or development will cause temporary displacement of caribou and birds, and may require hunters to travel farther from their camps and cabins. These impacts will be localized and temporary, but may intermittently impact a large number of users of the land, particularly in the northeast region of the NPR-A, where exploration and development is likely to be the most intense.

Under all alternatives, any further development of fixed facilities in areas of traditional use is likely to result in voluntary displacement of subsistence. Given the current impact of Alpine on land-use patterns among Nuiqsut hunters, any further development in close proximity to that community will substantially increase their travel distances and the subsequent risk of injury.

Acculturative Stress

Under Alternative C, as with Alternative A, the current trends in acculturation and its subsequent health impacts are likely to continue. Under all alternatives, isolation of outside workers into segregated work camps and the low levels of direct Iñupiat employment in the oil and gas industry will continue to provide some protection against acculturative stress. Villages where industrial activity occurs in close proximity will be at greatest risk, particularly if there is more open access between the local population and the work camps.

Economic Impacts

Health impacts from economic conditions are likely to be the similar under all alternatives. Revenue to the North Slope Borough and village corporations will allow for the continued funding of existing health and social programs and the preservation of the current high level of indirect employment. New jobs in the oil and gas sector will continue to be created, though too few will go to Iñupiat workers to create any local health benefit. Increases in alcohol, drug use, and sexually transmitted infections will be expected, commensurate with the level of economic growth and the degree of contact between outside workers and local populations.

Health Care Services

The impact on health care services under Alternative C will be largely the same as under Alternative A (see section 4.3.21.2 in Volume 2). Tax revenues from ongoing exploration and development will support the continued provision of the current level of health care services in the North Slope Borough and should not significantly impact demand. Increased occurrences of injury and trauma (see safety, above) will be sporadic and will be well within the capacity of acute care and search and rescue services in Barrow. The likelihood an increase in demand to health care services under Alternative C is low. Although budgetary constraints for health care services are possible with declining exploration and production in the future, it is unlikely that these will result in significant changes in public health.

4.6.21.3 Effectiveness of Stipulations and Required Operating Procedures

The management actions described in section 2.2 and the stipulations and best management practices described in Table 2-3 (both in Volume 1) provide a number of important protections for public health and safety. For a description of the effectiveness of stipulations and best management practices relevant to Alternative C, please see section 4.3.21.3 in Volume 2.

4.6.21.4 Conclusion

Under Alternative C, the pattern of health impacts is likely to be similar to Alternative A. The transition in the burden of disease from one in which infectious disease predominated to one in which chronic disease is the primary driver of ill-health will progress among the Iñupiat as it has in other indigenous populations. As is the case with other subsistence-dependent Arctic regions, injuries and trauma will continue to carry a disproportionate share of morbidity and mortality when compared to the general Alaska and U.S. populations, and the risk of injury and trauma may also be exacerbated if climate change results in unusual or unpredictable weather, water, snow, and ice conditions that make travel more hazardous (Brubaker 2011), and dislocation of subsistence species require people to travel greater distances to find marine or land mammals or edible plants.

Oil and gas activities contribute to these trends and impact public health in a number of ways. The preservation and promotion of traditional uses of the land is a public health priority, both for the nutritional benefits associated with a subsistence diet and for the social cohesion and cultural value associated with traditional Iñupiat practices. Though economic development provides important health benefits through both individual employment and revenues to local governments, these benefits are balanced against the risk that result from an erosion of traditional culture and diet, and exposures to environmental contaminants, social ills, and infectious disease.

Under Alternative C, as is the case with all alternatives, localized exploration activity will create transient impacts on subsistence by way of diversion of hunters and animals. In addition, noise from air traffic and other sources will create a nuisance around individuals' camps and cabins. Potential contamination of food and surface water is possible, though measurable public health impacts resulting from such contamination are unlikely under normal operating conditions. However, the perception of contamination of traditional foods is already a problem in the region. Further development around villages and in areas of traditional land use under Alternative C may worsen this perception, and could exacerbate the shift away from a subsistence diet.

Fixed production sites, particularly those in the vicinity of villages and in areas of heavy subsistence use of the land, will have an impact on public health under Alternative C. The avoidance of developed areas by hunters increases travel times and costs associated with subsistence activity, and as a result, will potentially decrease harvests and increase the risk of injury and accidents while on the land. Episodes of poor air quality associated with dust or emissions will pose a health hazard for at-risk populations such as those suffering from chronic obstructive pulmonary disease or asthma. The preclusion of fixed production pads from some areas of heavy subsistence use under Alternative C will help prevent some of these impacts.

The economic impact of activity under Alternative C will allow for a continuation of funding for current levels of services and maintenance of the current level of indirect employment, particularly through the North Slope Borough. Given current conditions, it is unlikely that new employment for the Iñupiat in the oil and gas sector will be significant enough to positively impact public health, though jobs for the individuals who get them will be an important health determinant. The health risks associated with economic growth and in-migration, namely increased use and access to alcohol and drugs and the spread of infectious disease and sexually transmitted diseases will be commensurate with the level of employment, road access, and the degree to which outside workers fraternize with local populations. The continued focus on the development of isolated work camps will temper these impacts.

4.6.21.5 Potential New Mitigation Measures (new best management practice)

The objective and requirement/standard for all potential new public health mitigation measures would be the same as those described in section 4.3.21.5. The potential benefits and residual/unavoidable impacts would be similar to those described for Alternative A at section 4.3.21.5 in Volume 2.

Section 4.7:

Impacts of Alternative D

4.7 Alternative D

4.7.1 Air Quality and Climate

This section qualitatively describes the potential air quality impacts associated with Alternative D.

4.7.1.1 Activities Not Associated With Oil and Gas Exploration and Development

Air quality impacts associated with these activities are the same as those associated with Alternative A, discussed in section 4.3.1.1 in Volume 2.

4.7.1.2 Oil and Gas Exploration and Development Activities—Air Pollutant Emission Sources

The air pollutant emission sources and effects of air pollution are the same as those associated with Alternative A, discussed in section 4.3.1.2 in Volume 2.

Development and production activities can also produce fugitive dust emissions (primarily as PM_{10}). Fugitive dust occurs primarily during the summer months due to driving on unpaved roads. Vehicles can also track out fine material from gravel mining operations in the winter and summer months. Potential control measures include limiting vehicle speeds, and treating problematic road sections with surfactants or water.

Well closure, abandonment, and reclamation activities would emit air pollutants similarly to those during development (construction), since similar vehicles and other emission sources would be used. Because closure activity would not occur at a single location for any substantial length of time, the impact of air emissions at any single location would likely be short term. Impacts could be minimized by leaving gravel on-site, limiting the amount of transport. Once reclamation is complete, production facilities would no longer impact air quality in the planning area (USDOI BLM 2008).

4.7.1.3 Effectiveness of Stipulations and Best Management Practice

Best Management Practice A-9 requires that all oil and gas operations that burn diesel fuels use ultra-low sulfur diesel as defined by the Alaska Department of Environmental Conservation-Division of Air Quality. Effective December 1, 2010, the Alaska Department of Environmental Conservation adopted the EPA regulation that requires the use of ultra-low sulfur diesel fuel in all vehicles and equipment. This requirement would apply to all BLM-authorized oil and gas operations (including contractor vehicles and equipment).

Best Management Practice A-10 would provide substantial protection for air quality within the NPR-A. Pre- and post-project ambient air quality monitoring would provide an understanding of air quality in the NPR-A relative to standards and thresholds. Air quality modeling would provide an estimate of potential post-project impacts and could provide guidance on the most effective pollution control strategies to employ once the project is completed.

Consistent with 40 CFR Part 69, beginning on December 1, 2010, the diesel fuel that is designated for use in rural Alaska for all on-road and non-road vehicles and equipment, locomotive, and marine will be ultra-low sulfur diesel fuel (15 parts per million sulfur). Ultra-low sulfur diesel was designated for use for on-road vehicles in urban Alaska on October 15, 2006; for non-road vehicles and equipment on December 1, 2010; and will be designated for locomotive and marine vehicles on December 1, 2012. Urban Alaska is defined as those geographical areas of Alaska designated by the State of Alaska as being accessible by the Federal Aid Highway System. Areas not accessible by the Federal Aid Highway System are considered rural (Elson 2011).

As a trace constituent in diesel fuel, sulfur compounds may cause adverse air quality impacts through formation of sulfate particulate matter (affecting visibility) and deposition of acidic aerosols. These impacts would be reduced significantly by utilizing ultra-low sulfur diesel fuel. In addition, ultra-low sulfur diesel fuels burn cleaner and produce less light absorbing carbon particulate matter (soot, also called black carbon). When burned, ultra-low sulfur diesel emissions are much lower than those generated by previous fuels, reducing fine particulate (soot), sulfuric acid, and sulfate (visibility) impacts.

4.7.1.4 Conclusion

Exploration, development, and production activities are expected to cause increases in the concentrations of criteria pollutants, hazardous air pollutants, volatile organic compounds, and greenhouse gases. Emissions and resulting air quality impacts from Alternative D are projected to be the highest of all alternatives due to more federally owned subsurface being available for oil and gas leasing. As a result, air pollution would be proportionately increased compared to Alternatives A, B-1, B-2, and C.

For a discussion of air quality modeling analyses, see section 4.3.1.4 in Volume 2 and Appendix H. The BLM modified best management practice A-10 in the Final IAP/EIS to better address potential air quality impacts.

4.7.2 Paleontological Resources

4.7.2.1 Activities Not Associated With Oil and Gas Exploration and Development

Under Alternative D, the types of non-oil and gas activities would be the same as those described for the no-action Alternative, Alternative A (4.3.2.1 in Volume 2), and the potential impacts to paleontological resources would be the same.

4.7.2.2 Oil and Gas Exploration and Development Activities

Effects of Seismic Surveys

The level of seismic activity would increase substantially compared to Alternative A (section 4.3.2.2 in Volume 2). The increase could be as much as 25,310 survey/camp train miles (45 percent) and 248,551 surveying/camp train acres (46 percent). However, given the low probability of impact from seismic activity, this would not be a meaningful increase in terms of potential impact to paleontological resources. Therefore, the probability of disturbance and impact to scientifically significant paleontological material under Alternative D remains low.

Effects of Short-term Disturbance: Exploration and Delineation Drilling

Short-term impact-producing activities include drill pads, roads, and airstrips constructed of ice and snow. Under Alternative D, gas well drilling and delineation activities would increase substantially compared to Alternative A, causing concomitant increases in the construction of associated ice and snow infrastructure. Overall, this activity would increase to more than 459,500 acres about 41 percent greater than Alternative A (section 4.3.2.2 in Volume 2). Despite the increase in acreage, the potential impacts to paleontological resources remains low, as modern exploration and delineation activities historically have had little impact on the resource.

Effects of Long-term Disturbance: Development of Oil and Gas Infrastructure

The amount of potential disturbance to paleontological resources from construction of central processing facilities and associated satellite pads, roads, airstrips, pump/compressor stations, and gravel pits in regard to surface area is increased to more than 16,300 acres about 6,400 acres (65 percent) more than Alternative A. About 55 million cubic yards of gravel would be extracted; an increase of about 15million cubic yards (37 percent) compared to Alternative A (section 4.3.2.2 in Volume 2). Also by comparison, the number of potential vertical support members would be the same, while gas pipeline trenching would increase by 1,385 miles, nearly double of Alternative A, thus potentially adding more than 5.3 million cubic yards to the total of excavated material. While the area of potential impact has increased, the level of potential impact would remain relatively low.

Effects of Oil Spills and Gas Releases

The effects of spills on paleontological resources would be essentially the same as discussed under Alternative A (section 4.3.2.2 in Volume 2). Although the area of potential impact would increase, the level of impact risk remains low. As previously described, there would probably be no adverse effect on paleontological resources from a gas release.

Effects of Abandonment and Reclamation

Abandonment and reclamation of short-term and long-term infrastructure, under most circumstances, would have limited, if any, impact on paleontological resources (see section 4.3.2.2 in Volume 2).

4.7.2.3 Effectiveness of Stipulations and Best Management Practice

Under Alternative D, the primary safeguard for paleontological resources is Best Management Practice E-13, which states that lessees will conduct a paleontological resources survey prior to engaging in any potential ground-disturbing activity.

4.7.2.4 Conclusion

Under Alternative D, the primary potential impact to paleontological resources would result from the excavation of gravel for construction of the permanent facilities. However, surveys for paleontological resources are required to be conducted before excavation or any potential ground-disturbing activities could take place. Overall, given the effectiveness of the protection for, and the distribution, density, and context of paleontological resources, both non-oil and gas and oil and gas-related activities within the NPR-A have a very low probability of adversely impacting paleontological resources. The potential effect of climate change is the same as described for Alternative A.

4.7.3 Soil Resources

4.7.3.1 Activities Not Associated with Oil and Gas Exploration and Development

Various types of activities not related to oil and gas leasing and development, including private or commercial air traffic, summer research camps, use of off-highway vehicles, recreational camps, paleontological and archaeological excavations, and overland moves could affect soil resources in the planning area under Alternative D.

Under Alternative D, impacts associated with non-oil and gas activities would be similar to those described under Alternative A for all alternatives. These activities could occur throughout the planning area and would be little affected by the increased availability of land for oil and gas leasing.

4.7.3.2 Oil and Gas Exploration and Development Activities

The following analysis is based on section 4.2.1.2, "Oil and Gas Exploration and Development Activities" in Volume 2. See that section for a discussion of estimates and assumptions for development as well as a description of how estimated areas of disturbance were calculated for each alternative.

During oil and gas exploration and development, various activities could cause impacts to soil resources in the planning area. These activities include seismic activities; construction and use of gravel pads, gravel roads, gravel airstrips, and pipelines; excavation of material sites; construction of ice roads and ice pads; and summer tundra travel. Impacts could also occur from oil spills and from removal of gravel pads and gravel roads during reclamation. These activities would impact soil productivity and could alter the moisture regime of tundra near the structure by changing natural drainage patterns and areas where snow accumulates. Types of impacts to soils from oil and gas activities in Alternative D would be similar to those described for Alternative A. Differences in the magnitude and area of impacts for Alternative D are described below.

Effects of Disturbances

Seismic Surveys

The type of effects to soils from seismic surveys would be the same as for Alternative A. Under Alternative D, it is assumed there would be five more seismic surveys (one additional 2-D and four additional 3-D) than for Alternatives A, B-1 and B-2, and two additional 3-D surveys than for Alternative C. Since vegetative cover will only be minimally impacted, soil disturbance is also projected to be minimal. Short-term disturbance from 2-D and 3-D seismic surveys combined would total a maximum of 733,451 acres and for seismic camp moves would total 53,152 acres. The overall total for surveys and camp moves would be 786,603 acres (3.5 percent of the 22.8 million-acre NPR-A). Long-term disturbance (greater than 8 to 9 years) is estimated to total 2,658 acres.

Exploration

Under Alternative D, types of impacts to soil from activities associated with oil and gas exploration would be similar to those described for other alternatives. There would be a greater number of exploration and delineation wells drilled for gas than under the other three alternatives. There would be the same number of exploration wells drilled for oil in Alternative D as under Alternatives A and C, but 88 percent more than under Alternative B-1 and 50 percent more than under Alternative B-2. Exploration wells for gas would be greatest under Alternative D, which would be 44 percent more than Alternative A, double that of Alternative B-1, 75 percent more than Alternative B-2, and 6 percent more than Alternative C.

The drilling of exploration and delineation wells would result in impacts to soil from both multi- and single-year ice pads. The area of soil directly impacted by a typical ice pad (500 feet by 500 feet) would be approximately 6 acres. During the life of the plan, it is assumed that 128 exploration wells and 128 delineation wells for oil or gas, or a total of 256 wells, would be drilled from ice pads in the NPR-A under Alternative D. At 6 acres per pad, these would impact 1,536 acres of tundra, spread out over 30 years (31 percent more than Alternative A, double the number under Alternative B-1, 68 percent more than Alternative B-2 and 5 percent more than Alternative C).

Under Alternative D, ice road and snow trail construction would also increase in terms of total miles because of the increase in number of exploration/delineation wells and permanent facilities constructed. The total short term disturbance from ice roads over 30 years would be 456,683acres, about 41 percent more than for Alternative A, 97 percent more than Alternative B-1, 83 percent more than Alternative B-2 and 6 percent more than Alternative C. Soil recovery from ice road impacts is expected within a few years (Yokel et al. 2007), so long-term disturbance from ice roads should be negligible. Although some evidence of crushed tussocks may still be apparent, soil exposure is not expected. A few areas of minor subsidence may be visible for many years.

Ice airstrips are also used during exploratory drilling, and under Alternative D, it is assumed that 120 ice airstrips would be constructed over 30 years, covering 11 acres each for a total of 1,320 acres (20 percent more than for Alternative A, 85 percent more than Alternatives B-1 or B-2, and 4 percent less than Alternative C). These airstrips are commonly built on the grounded ice of large lakes, but if they were built over tundra, they would result in impacts similar to ice roads.

The construction of well cellars during exploration requires the digging of a hole that destroys soils on approximately 64 square feet (0. 0015 acre) of ground. Thermokarst associated with the disruption of thermal regime in the surrounding soil may also change the soil pedon around the well cellar to a wetter regime. These impacts could result in 0.4 acre of soil being destroyed under Alternative D (30 percent more than Alternative A, twice that of Alternative B-1, 68 percent more than Alternative B-2, and 5 percent more than Alternative C).

Development and Production

During oil and gas development and production, various activities could cause impacts to soils in the NPR-A. These activities include construction and use of gravel pads, staging areas, roads, airstrips, pump stations, compressor stations and pipelines, excavation of material sites, and construction of ice roads and ice pads. Ice roads and pads are covered above.

Placement of Gravel Fill

Types of impacts to soils from placement of gravel fill would be similar to those in Alternatives A, B-1, B-2, or C. Construction of central processing facilities or central gas facilities and associated satellite pads, roads, and airstrips would result in the loss of soil productivity in the areas of gravel placement. Under this alternative, 12 central processing facilities and 42 central gas facilities, and associated satellite pads, roads and airstrips, two pump stations, one compressor station and eight staging bases would be developed, resulting in 10,439 acres of soil productivity lost by gravel placement (48 percent more than under Alternative A, 48 percent more than under B-1, 86 percent more than under Alternative B-2, and about 8 percent more area than under Alternative C).

Construction of gravel pads, roads, staging areas, and airstrips could alter the moisture regime of tundra near the structure by changing natural drainage patterns and areas where snow accumulates. Snowdrifts caused by gravel structures would increase the wintertime soil surface temperature and increase thaw depth in soils near the structures. These impacts would be exacerbated by dust deposition and by the formation of impoundments. These factors could combine to warm the soil, deepen thaw, and cause thermokarst adjacent to roads and other gravel structures (National Research Council 2003). In flat, thaw-lake plains on the North Slope, gravel construction can be anticipated to result in upslope water impoundment and thermokarst erosion equivalent to the area directly covered by gravel (Walker et al. 1987). The increased construction and use of facilities under Alternative D would result in a larger area being impacted by dust than under the other alternatives. Assuming a total of 1,046 miles of in-field gravel roads and 53 airstrips (50.2 miles), there is a potential for a total perimeter of 2,192 miles. Within 30 feet of gravel fill, up to 7,972 acres of soil could be subject to loess deposition by dust and gravel, and another 31,889 acres could be affected by a dust shadow, which could decrease surface reflectance and increase the depth of the active layer.

In general, most changes in the soil pedons around gravel structures would occur within 164 feet of the structure. If all effects were to occur within this zone, a maximum of 43,574 acres would be impacted under Alternative D (49 percent more than under Alternative A, over twice that of Alternative B-1, 85 percent more than under Alternative B-2, and 8 percent more than under Alternative C). Note that this area includes the 39,861 acres affected by dust above, and is not in addition to it.

Material Sites

Gravel required for development in the planning area could be mined from existing sites east of the planning area and could be extracted from new sites developed within the planning area. Investigations to identify gravel sources in the planning area have not been conducted, but presumably would be initiated if discoveries of recoverable oil or gas were made. Under Alternative D, it is assumed that up to 55 material sites would be needed. This would cover a total area of 2,088 acres (48 percent more than

Alternative A, over twice that of Alternative B-1, 86 percent more than Alternative B-2, and 8 percent more than Alternative C). Types of impacts from gravel excavation would be similar to Alternative A and the other alternatives. Excavation of the gravel mine and stockpiling of overburden would remove soil and impact soil productivity at these sites.

Pipelines

Under Alternative D, types of impacts to soil from pipelines would be similar to those described in other alternatives. Given the potential number of fields developed in this analysis, impacts from pipeline construction would be greater than those described for other alternatives. The total area disturbed by each vertical support member would be about 15 square feet. About 6 percent of this area would be soil destroyed and replaced by the vertical support member, and the remaining portion would be potentially altered in terms of organic matter and horizon formation. Approximately 0.05 acre of soil would be disturbed per pipeline mile for oil gathering pipelines, and 0.03 acre per mile of regional oil pipelines. Under Alternative D, 224 miles of gathering lines for oil and 594 miles of regional oil pipelines would disturb 29 acres of soil through vertical support member placement or the same as under Alternative A,45 percent more than Alternative B-1, 37 percent more than Alternative B-2, and the same as Alternative C. Ice roads built for construction of these pipelines would have short-term impacts to soils on less than 3,468 acres. In reality, some of the vertical support members for gathering lines would be over gravel pads and would have no impacts on soils, nor would ice roads be necessary for construction of these portions of pipeline. Because pipeline burial under tundra has been the exception on the North Slope rather than the norm, it is expected that this activity would disturb only a small amount of area in the planning area.

It is assumed that gas pipelines (2,076 miles) would be buried, so impacts to soil would be different than for oil pipelines. In the case of buried gathering, regional and high-pressure gas pipelines, short-term disturbance from ice roads would affect 12,582 acres. Long-term impacts from trenching and spoils storage would occur on 3,775 acres. Melting of ice in the soils would result, and the filled area, normally mounded immediately after placement of fill, would level over time as melt water migrated to lower areas. Compaction and thermokarst are likely to be the primary indirect effects of pipeline construction. In addition, ice roads that may be associated with placement of the gas pipeline would have localized, short-term impacts on soils, which would usually be limited to compression of the tundra under the ice roads and damage to the tops of tussocks in drier soils. These impacts would be dramatically reduced if gas pipelines were put on vertical support members.

Summer Tundra Travel

Under Alternatives B-1, B-2, C, and D, some summer tundra travel would be permitted under specific circumstances. Although travel off of gravel pads is easiest in winter and generally environmentally preferable at that time, some vehicle travel off of pads does occur in North Slope oil fields during the summer to accomplish specific tasks. The State of Alaska has approved some low-ground-pressure vehicles for summer tundra travel after July 15. Similar summer tundra travel may be anticipated to be part of oil production in the northeastern NPR-A.

Summer vehicle tundra travel is commonly associated with spill prevention and preparedness measures required in spill-prevention plans. Each summer season, low-ground-pressure vehicles might be used to transport and place booms across streams downstream from pipelines. These booms are left in place through the summer to capture any oil that might spill from a pipeline and then would be retrieved, again probably using low-ground-pressure vehicles, before freeze-up. Pipeline inspections may also entail summer vehicle travel on the tundra. Finally, periodically, spill response training may occur along and downstream from pipelines in summer.

As a rule, summer tundra travel would not be permitted under Alternative A. Therefore, given the potentially greater number of fields developed and allowance of summer tundra travel under certain circumstances, impacts from summer tundra travel under Alternative D could be greater than in the other alternatives. Short-term, minor impacts to soils are expected from limited summer tundra travel using low-ground-pressure vehicles. However, Required Operating procedure L-1 is designed to regulate and monitor summer travel and minimize impacts to soils and vegetation. Summer travel would only be permitted on a case-by-case basis if the applicant can demonstrate that the proposed use would have no more than minimal impacts to soils and vegetation.

Effects of Oil and Gas Development on Permafrost

Types of impacts to permafrost from oil and gas development would be the same as those described in Alternative A. Under Alternative D, more surface disturbance is expected from oil and gas activities as compared to the other alternatives (Table 4-14 in Volume 2). Therefore, the potential area of permafrost impacted would be expected to be greater than in any other alternative. Soils disturbed in the ice-rich northern part of the planning area are more likely to experience thermal degradation and subsidence as a result. In this case, the soils would not be lost completely, but soil horizons as well as the thermal regime would be altered. Melting of ice in the soils would result and the filled area, normally mounded immediately after fill, would level over time as melt water migrates. Ponding, and potentially soil erosion, could occur if a trench or surface subsides below the grade of the surrounding terrain over time. These impacts would be dramatically reduced if pipelines were put on vertical support members.

Effects of Spills

Under Alternative D, types of impacts to soils from spills would be similar to those described for Alternative C. However, the potential for a greater amount of leasing, development, and production of oil could result in a larger number of small spills of crude and refined oil, produced water and seawater in the planning area compared with the other alternatives. There would also be a greater chance of a large oil spill occurring than with the other alternatives; nonetheless, a large spill would still likely be a very rare event (see section 4.2.2.1, “Oil Spills” in Volume 2) but one event has been analyzed.

Most oil spills cover less than 500 square feet (less than 0.01 acre); although a pressured aerial mist may cover up to 145 acres (Ott 1997). (Such a spill is a very low probability event, occurring less than once out of the total spills expected throughout the life of this plan. Thus, its magnitude is not apparent in the following acreages). If 11percent of all oil spills would reach soils during summer, under Alternative D this would mean 65 of the 588 crude and refined oil spills assumed to occur over the life of the plan would have more than a negligible effect on soils. Assuming the average spill would cover 0.1 acre, under Alternative D approximately 6 acres would be impacted substantially during the lifetime of development in the NPR-A. This is about the same as the acreage impacted under Alternative A, twice that impacted under Alternative B-1, 75 percent more than under Alternative B-2, and 44 percent more than under Alternative C. Overall, past spills on Alaska's North Slope have resulted in minor ecological damage and ecosystems have shown good potential for recovery (Jorgenson 1997).

A single gas release occurring with ignition could have thermal effects to approximately 194 acres of tundra soil (500-meter radius). The assumed number of gas releases under Alternative D (6.2 = 2,076 miles of pipe at a rate of 0.9 incidents per 300 pipe miles), if ignited, would result in thermal effects to approximately 1,208 acres of tundra soils. If a wildfire resulted, additional acreage would burn, the amount depending on season, weather conditions, moisture content of vegetation and soil organic matter, and suppression effort. Most North Slope tundra fires are less than 1,000 acres (Racine and Jandt 2008). Total soil cover following lightning-caused tundra fires reached 50–100 percent after 5 to 6 years (Racine et al. 1987). Severely burned areas may not be capable of supporting vascular plants until they have gone through early development, which starts with lichens. Lichens, however, could take several decades to recover if they can achieve former densities at all under a climate-warming regime (Jandt et al. 2008).

Abandonment and Reclamation

Types of impacts from abandonment and reclamation would be the same as those described in Alternative A. Under Alternative D, it is expected that more structures would be constructed for oil and gas activities as compared to the other alternatives (Table 4-14 in Volume 2). Therefore, the amount of reclamation required, and impacts to soils from abandonment and reclamation under Alternative D, would be greater than other alternatives.

During abandonment activities, soils and wetlands would be impacted by dust deposition along roads, by ice roads and other off-road tundra travel associated with dismantling of pipelines and power lines, and by disturbance to soils adjacent to vertical support members and power line poles during their removal. The level of impact from these activities would be roughly the same as that during construction if gravel fill was removed; impacts would be less if the gravel were left in place. If roads and pads were left in place, and especially if cross drainage across roads was not maintained, water impoundment would occur and could alter soil properties and permafrost as described for the construction period. It is also likely that the unmaintained roads would have occasional washouts where soils would be covered with washed-out gravel by the alluvial process.

Roads and pads, if left in place, would likely take many years to establish a soil profile and an associated vegetative community. Soil formation may need to start with lichens and other native plants indigenous to streambeds and barren soils. Building a soil profile may take several decades or more, given the cold and low moisture conditions of the NPR-A. Revegetation activities could take several years, as initial attempts are not always successful. Removal of gravel from pads, roads, and airstrips could be mandated. Partial or complete removal of gravel can result in further damage to the soils and an increased potential for subsidence because the insulating vegetation has been removed. Thaw subsidence is difficult to predict, and complete restoration to preexisting conditions is improbable. In general, impacts from abandonment and reclamation for Alternative D would be greater than what would occur under the other alternatives, given the numbers of fields likely to be developed under each of these alternatives.

4.7.3.3 Effectiveness of Stipulations and Required Operating Procedures

To protect soils in the planning area, the approval of most proposals for summer operations is limited. Because of the fragile nature of thawed tundra during the summer, permit sites are restricted to durable areas such as gravel bars, beaches, or existing gravel pads. Vehicles allowed for use in overland moves would exert low ground pressure and be permitted to travel only over snow-covered ground frozen to a sufficient depth to minimize soil and vegetation impacts. Even so, development in the planning area would result in impacts to soils. However, several lease stipulations and required operating procedures for Alternative D should be effective in limiting these impacts. Lease stipulations and required operating procedures developed to protect soil under Alternative D would provide similar protection to those developed for Alternatives B-1, B-2, and C. The exceptions to this are that under Alternative D there would be no lease stipulations K-3, K-7, K-8b, K-9, or K-10, and the restrictions under K-4a would be reduced. All of these measures affected where infrastructure could be placed in certain areas. Since the lifting of these restrictions under Alternative D could make more oil and gas economically recoverable, it is likely that more soils (16,329 acres) would be destroyed or disturbed under Alternative D than under the other alternatives: A (9,902 acres), B-1 (7,505 acres), B-2 (8,402 acres), or C (15,311 acres). The best management practices and lease stipulations associated with Alternative D would reduce impacts by ensuring the minimum necessary destruction of soils and alteration of plant communities, given that infrastructure would be permitted in various areas.

4.7.3.4 Conclusion

Under Alternative D, the amount of soil area impacted from oil and gas exploration and development would potentially exceed those of all other alternatives, as additional high-potential oil and gas areas would be available for leasing. See Table 4-14 in Volume 2 for a comparison of estimated total surface area disturbed by alternative. Loss of permafrost and soil insulation from activities associated with this alternative could be exacerbated by climate change as described in the conclusion of Alternative A.

Numerous technological advancements have been made during the decades of operations on the North Slope that have allowed current development activities to proceed with less environmental impact than previous operations (National Research Council 2003). However, some short-term disturbance and permanent long-term impacts to soils are inevitable. Impacts to soil from management actions under Alternative D would involve short-term disturbance over fairly large areas and long-term disturbance of relatively small areas. Impacts in this alternative cover more of the planning area than the other alternatives.

Under Alternative D, impacts to soils from activities other than oil and gas development would be essentially the same as those under the other alternatives. The duration of these impacts would be short-term, ranging up to 5 months, and recovery would vary from one to several years, or even decades, if the soil was destroyed or permafrost thawing was extensive.

As with the other alternatives, impacts to soils from oil and gas exploration under Alternative D would occur from seismic work and construction of well cellars during exploratory drilling and the construction of ice roads and ice pads. The duration and recovery time for impacts associated with seismic work would be similar to those for overland moves and the same as for the other alternatives. Based on earlier studies, there should be no substantial, long-term impacts to soils from seismic lines, but substantial impacts from camp move trails could remain on approximately 2,658 acres after 8 to 9 years. Effects of well cellar construction would also be permanent, but would impact only 0.4 acre of soil.

Under Alternative D, the effects of oil and gas development and operation would include compaction, destruction, or burial of soil during construction of gravel pads (central processing facilities and central gas facilities, satellite drill pads, pump and compressor stations, and staging bases), roads and airstrips; from excavation of material sites and burial of gas pipelines; and construction of vertical support members. These impacts would be long-term and would impact about 16,329 acres, or 0.07 percent of the 22.8 million-acre NPR-A (as compared to 0.04 percent under Alternative A, 0.03 percent under Alternative B-1, 0.04 percent under Alternative B-2, or 0.07 percent under Alternative C). Soil pedons could also be altered by dust deposition, salinity of gravel fill used in construction, snowdrifts, and blockage of or change to natural drainage patterns. These impacts would also be long-term and would impact about 43,574 acres, or 0.19 percent of the NPR-A (63 percent more than the amount of soil impacted under Alternative A, 110 percent more than Alternative B-1, 103 percent more than under Alternative B-2, or 18 percent more than under Alternative C).

It is assumed that impacts to soils would occur in proportion to their occurrence within the NPR-A. Since there are fewer restrictions on infrastructure under Alternative D than any other alternative, that assumption is more likely to hold true under Alternative D.

Areal extent of short-term impacts under Alternative D would be about 42 percent more than for Alternative A, 98 percent more than under Alternative B-1, 84 percent more than Alternative B-2, and 6 percent more than for Alternative C. Areal extent of long-term impacts under Alternative D would be about 65 percent more than for Alternative A, 118 percent more than under Alternative B-1, 94 percent more than Alternative B-2, and 7 percent more than for Alternative C. Impacts to soils from non-oil and gas activities, and from oil and gas activities would likely be additive, except in those areas where the two types of activities overlapped. Impacts to soils from exploration and development activities would also be additive, except where development activities occurred in areas previously disturbed during exploration. In areas where two or more activities occurred, overall impacts would reflect those impacts associated with the first activity and any new impacts associated with later activities.

Impacts associated with oil spills, the majority of which would be cleaned up immediately, could adversely affect soil resources for a few years to several decades depending on the quantity, location, and season of the spill. Based on oil and gas potential and the estimated number of large and small spills, impacts from oil spills could be greater under Alternative D than under the other alternatives (see section 4.2.2.1, “Oil Spills” in Volume 2).

Only under Alternatives B-1, B-2, C and D, would some summer tundra travel be permitted under specific circumstances. Short-term, minor impacts are expected from limited summer tundra travel using low-ground-pressure vehicles. However, Best Management Practice L-1 is designed to regulate and monitor summer travel and minimize impacts to soils and vegetation. Summer travel would only be permitted on a case-by-case basis if the applicant can demonstrate that the proposed use would have no more than minimal impacts to soils and vegetation.

4.7.4 Surface and Groundwater Resources and Water Quality

Alternative D would maximize leasing opportunities within NPR-A, offering 100 percent of the lands to be made immediately available for oil and gas leasing, though leasing in lands currently deferred from leasing would not be offered for lease pending expiration of the deferrals. This alternative would provide areas for corridors the precise location of which is to be determined at a later date to bring oil and gas from potential future offshore development in the Chukchi and Beaufort seas to market. Section 2.3.4 describes this alternative in greater detail. Based on potential for leasing, Alternative D would have the highest potential for impacts to water resources and quality from exploration and development.

4.7.4.1 Activities Not Associated With Oil and Gas Exploration and Development

Under Alternative D, impacts to water resources and quality associated with non-oil and gas activities would essentially be the same as those described under Alternative A, section 4.3.4.1 in Volume 2.

4.7.4.2 Activities Associated With Oil and Gas Exploration and Development

Effects of Seismic Surveys

Modern-day seismic equipment has caused minimal impact to the tundra, but camp move vehicles can still cause thermokarst, especially when snow is insufficient to protect soil and vegetation (WesternGeco 2003). Removal or damage of the organic mat exposes soils to erosion by wind and water, which could deposit sediment into waterbodies resulting in higher turbidity and concentrations of suspended sediment. To cause high turbidity, the peat mat must be sufficiently eroded to expose underlying mineral soils, and the mineral soils must be fine grained. Best Management Practice C-2 requires ground operations to commence only when frost and snow are at sufficient depths to protect stream banks, and minimize the breakage, abrasion, compaction, or displacement of vegetation and prevent future thermokarst.

Studies of impacts to vegetation from seismic activity are discussed in section 4.3.5.2 in Volume 2. It is estimated that a total of 2,658 acres of moderate to high impacts from seismic activities could result from Alternative D, more than all other alternatives. These long-term impacts may result in thermokarst erosion with increased turbidity in local waterbodies.

Effects of Water Withdrawal from Lakes

The primary source of water during the winter months is unfrozen water that lies beneath the ice cover of both shallow and deep lakes. This water is somewhat saline because of the exclusion of ions during the freezing of the upper part of the lake. Water from lakes may be used for ice roads, pads and airstrips, and for drilling and production water and potable water at drilling facilities, but the volume of water taken from an individual lake depends on the depth of the lake, depth of unfrozen water in the lake and the presence of fish and the type of fish present.

Best Management Practice B-2 insures water permitting requirements are followed and are supplemented by water monitoring plans as needed to insure lakes are replenished. Effects during exploration on water quality from water withdrawals would be short term and minor, returning to normal levels after breakup. Alternative D, with the highest number of wells to be drilled is expected to require greater amounts of water than all other alternatives. The provisions under Alternative D are adequate to insure water quality and quantity is maintained after water withdrawals.

Effects of Ice Roads, Ice Pads and Ice Bridges

Ice roads and ice pads are used extensively during the winter exploration season for access and for exploration drilling and testing. Best Management Practice C-3 requires river crossings to be made at low angles if at all possible, and remove, breach, or slot ice bridges before breakup. Ice roads may be required to be breached at stream crossings, especially if fish passage is a concern or the quantity of expected flow is significant during breakup. Under all of the alternatives, no long-term impacts are anticipated from ice roads, ice pads or ice bridges.

Effects of Exploratory Drilling

Drilling operations require large amounts of water to create drilling fluid, which must be disposed of at the completion of drilling operations. Drilling fluid is typically a preparation of water, clay, and chemicals that is circulated into a well during drilling and must be disposed of when operations cease. Best Management Practice A-2 requires all cuttings and drilling mud to be disposed of by injection, allowing on-pad temporary storage of muds and cuttings, as approved by Alaska Department of Environmental Conservation. Freshwater aquifers are protected by surface casing, which is installed and cemented in place at depths that are determined by State natural gas and oil regulatory agencies. Lease Stipulation D-1 prohibits exploratory drilling in rivers and streams, as determined by the active floodplain and fish-bearing lakes unless there is no feasible or prudent alternative. These protective measures would decrease the risk of drilling muds or oil from blowouts from entering adjacent waterbodies.

Under Alternative D up to 256 oil and gas exploration and delineation wells may be drilled. Alternatives A, B-1, B-2, and C estimate 196, 128, 152, and 244 wells, respectively, may be drilled. The number of rigs estimated under Alternative D is greater than all other alternatives and impacts associated with drilling will be greater. Exploratory drilling under Alternative D, as well as all other alternatives, is not expected to have a measurable effect on water quality since spills would occur in the winter and will likely occur on ice pads.

Effects of Drainage Disruption by Gravel Roads, Pads, Runways and Pipelines

Drainage disruptions by gravel roads, pads, runways, and pipelines and their associated impacts from impoundments, thermokarst, erosion and sedimentation are discussed in section 4.3.4.2 in Volume 2. Best management practices and lease stipulations designed to reduce or eliminate these impacts are described in section 4.3.4.3 in Volume 2.

Because more or less infrastructure is estimated to occur in different alternatives, the potential for some shortcoming in design of infrastructure to result in impacts will vary with that variation among the alternatives. The stipulations and design requirements described above should provide adequate protection to ensure natural flow characteristics and water quality is maintained.

Under Alternative D, the BLM estimates 10,439 acres of gravel placement for production pads, in-field roads, and runways. This compares to Alternatives A, B-1, B-2, and C with 7,074, 5,037, 5,614, and 9,387 acres, respectively. Alternative D would have greater disruption of drainages, erosion, and sedimentation than all other alternatives. If lease stipulations and BMPs listed for this alternative are followed, impacts should be minor.

Effects of Gravel Pits

Removal of gravel from areas near streams and lakes can result in changes to stream or lake configurations, stream-flow hydraulics, lake shoreline flow patterns, erosion, sedimentation, and ice damming (National Research Council 2003). Locating gravel pits at an adequate distance from streams and lakes would minimize these impacts. Gravel mining in the coastal plain would create some localized sedimentation and new or enlarged waterbodies, particularly if gravel was extracted from within floodplains. Gravel extraction outside the floodplain, especially within the foothills, would be less likely to create new lakes, but could produce sedimentation. Best Management Practice E-8 would locate gravel mine sites outside active floodplains whenever possible.

Alternative D projects up to 55 gravel pits (2,088 acres), could be required for the development scenarios presented in Table 4-14 in Volume 2. This compares to 40 (1,415 acres), 29 (1,007 acres), 31 (1,125 acres) and 51 (1,868 acres) gravel pits, respectively, for Alternatives A,
B-1, B-2, and C.

Effects from Waterflooding

Waterflooding is a process of injecting water into underground reservoir rock to maintain reservoir pressure and maximize recoverable oil reserves. Alaska Oil and Gas Conservation Commission oversees the Underground Injection Control Program to ensure underground sources of drinking water are protected. Under Alternative D an estimated 826 oil production and service wells and 488 gas production and water disposal wells could be drilled, the highest of all the alternatives. Therefore, spills or groundwater contamination impacts from waterflooding will be more likely to occur under Alternative D than under other alternatives. Impacts to groundwater resources or from spills transporting seawater to wells for waterflooding are expected to be minimal.

Effects of Oil Spills and Gas Releases

Under Alternative D, the types of impacts to water resources and quality associated with oil spills and gas releases would essentially be the same as those described under Alternative A, section 4.3.4.2 in Volume 2. Section 4.4.4.3 in Volume 2 discusses stipulations and best management practices that would help reduce the risk of fuel-related spills.

Under Alternative D, the BLM estimates there could be 553 small spills of refined and crude oil less than 500 barrels in size. This compares to estimates of 525, 367,399, and 514 spills, respectively, from Alternatives A, B-1, B-2, and C. Alternative D predicts a 39 percent chance of one or more large oil spills greater than 500 barrels and a 57 percent chance of one or more large spills greater than 500 barrels of produced water or seawater, which are the greatest potential for spills than all other alternatives.

Effects of Abandonment and Reclamation

Removal of facilities, particularly roads, bridges, and culverts, would likely cause increased sedimentation and erosion immediately after removal. However, natural drainage will be reestablished within several years to more than a decade depending upon the facilities removed and the local hydrology and terrain. Leaving pads, airstrips, roads, bridges, and culverts in place, particularly without future maintenance, however, would result in longer-term, higher levels of erosion, sedimentation, and upslope impoundment. Ponds would be formed from melting of ice wedges or other ice underlying the gravel facilities. Leaving the roads in place, but removing bridges and culverts and breaching the roads where culverts had been placed, would reduce upslope impoundment.

Because a greater amount of gravel infrastructure would be created in Alternative D than all other alternatives, a greater amount of sedimentation, erosion, and water impoundment could result.

4.7.4.3 Effectiveness of Lease Stipulations and Best Management Practices

The lease stipulations and BMPS protective of water resources and water quality have been discussed in the above sections of Alternative D. A complete listing of these stipulations and BMPs are also listed in Alternative B-1, section 4.4.4.3 in Volume 2.

4.7.4.4 Conclusion

The potential impacts to water resources and quality from oil exploration and development activities under Alternative D include the following: turbidity changes of waterbodies due to thermokarst from seismic and overland travel activities and from dust effects adjacent to roads and pads; losses of water and possible water quality changes from water withdrawals; erosion and sedimentation associated with road and pad building; inadequately designed river crossing structures; impounded water at road crossings; alteration of drainages from pipelines, pads, ice and gravel roadways, airstrips, and gravel mines; and impacts on water quality from oil, produced water and seawater spills into waterbodies.

Global climate change could have unpredictable impacts on winter temperatures, water balance and availability of water, timing and magnitude of spring floods, rising sea level, storm surges, and coastal erosion. A shortened winter season and warmer soil temperatures could increase the potential to damage vegetation from seismic surveys and overland travel and result in thermokarst. A longer growing season could result in increased potential evapotranspiration reducing available water in lakes. Premature melting of ice roads could occur with sudden spring melts, requiring emergency demobilization of drilling operations in order to protect the tundra. Increased snowfall combined with late summer rainfall could increase the magnitude of spring peak flows above the normal range of flows. Greater expanses of open water on the Beaufort and Chukchi seas could increase the potential for storm surges to cause accelerating rates of coastal erosion and flooding of inland lakes and ponds. All alternatives under consideration would be affected, although fewer impacts under Alternatives B-1 and B-2 would occur due to less development in the Teshekpuk Lake area.

Adherence to federal and state operational guidelines, best management and safety practices, planning requirements, lease stipulations and best management practices will all serve to reduce impacts from these activities. Some localized, but temporary effects to water resources or quality may occur from most activities described in Alternative D. The exception would be the case for permanent gravel pads and stream crossing structures and very large spills, which would have long-term impacts described in the above sections.

In general, impacts between alternatives are proportional to acres available to leasing and projected future production. Alternative D would be expected to have more impacts to water resources and quality than all other alternatives.

4.7.5 Vegetation

4.7.5.1 Activities Not Associated with Oil and Gas Exploration and Development

Under Alternative D, impacts to vegetation associated with non-oil and gas activities would essentially be the same as those described under Alternative A.

4.7.5.2 Oil and Gas Exploration and Development Activities

Exploration

Under Alternative D, types of impacts to vegetation from activities associated with oil and gas exploration would be similar to those that occur under other alternatives. There would be a greater number of exploration and delineation wells drilled for gas than under the other alternatives, which would alter the impacts of well collar construction and the number and impacts of both ice pads and ice roads. There would be the same number of exploration and delineation wells drilled for oil as under Alternatives A and C, but 88 percent more than under Alternative B-1 and 50 percent more than under Alternative B-2.

Under Alternative D, it is assumed there would be five more seismic surveys (one additional 2-D and four additional 3-D) than for Alternatives A, B-1 and B-2, and two additional 3-D surveys than for Alternative C. Short-term vegetation disturbance from 2-D and 3-D seismic surveys combined would total a maximum of 733,451 acres and for seismic camp moves would total 53,152 acres (Table 4-11 in Volume 2). The overall total for surveys and camp moves would be 786,603 acres (3.5 percent of the 22.8-million-acre NPR-A). Long-term disturbance (greater than 8 to 9 years) is estimated to total 2,658 acres.

During the life of the plan, it is assumed that 128 exploration wells and 128 delineation wells for oil or gas, or a total of 256 wells, would be drilled from ice pads in the NPR-A under Alternative D. At 6 acres per pad, these would impact 1,536 acres of tundra, spread out over 30 years (31 percent more than Alternative A, 100 percent more than Alternative B-1, 68 percent more than Alternative B-2, and 8 percent more than Alternative C).

Under Alternative D, ice road and snow trail construction would also increase in terms of total miles because of the increase in number of exploration or delineation wells and permanent facilities constructed. The total short-term disturbance from ice roads over 30 years would be 456,683 acres, about 41 percent more than for Alternative A, 97 percent more than Alternative B-1, 83 percent more than Alternative B-2, and 6 percent more than Alternative C. Since vegetation recovery from ice road impacts is expected within a few years (Yokel et al. 2007), long-term disturbance from ice roads would be negligible. Although some evidence of crushed tussocks may still be apparent, new growth would preclude any exposed soils.

Ice airstrips are also used during exploratory drilling, and under Alternative D, it is assumed that 120 ice airstrips would be constructed over 30 years, covering 11 acres each for a total of 1,320 acres (20 percent more than for Alternative A, 85 percent more than Alternatives B-1 and B-2, and 4 percent less than Alternative C). These airstrips are commonly built on the grounded ice of large lakes, but if they were built over tundra they would result in impacts similar to ice roads.

The construction of well cellars during exploration requires digging a hole that destroys vegetation on approximately 64 square feet (0. 0015 acre) of ground. Thermokarst associated with the disruption of thermal regime in the surrounding soil may also change the vegetation type around the well cellar to a wetter vegetation type. These impacts could result in 0.4 acre of vegetation being destroyed under Alternative D (31 percent more than Alternative A, 100 percent more than Alternative B-1, 68 percent more than Alternative B-2, and 5 percent more than Alternative C).

Development and Production

During oil and gas development and production, various activities could cause impacts to vegetation in the NPR-A. These activities include construction and use of gravel pads, staging areas, roads, airstrips, pump stations, compressor stations and pipelines, excavation of material sites, and construction of ice roads and ice pads. Ice roads and pads are covered above.

Placement of Gravel Fill

Construction of central processing facilities or gas compressor facilities and associated satellite pads, roads, staging areas, pump or compressor stations and airstrips would result in the destruction of vegetation in the areas of gravel placement. Under this alternative, 12 central processing facilities and 42 gas compressor facilities, and associated satellite pads, roads and airstrips, two pump stations, one compressor station and eight staging bases would be developed, resulting in 10,439 acres of vegetation being destroyed by gravel placement (39 percent more than under Alternative A, 114 percent more than under Alternative B-1, 96 percent more than Alternative B-2, and about 8 percent more area than under Alternative C).

The increased construction and use of facilities under Alternative D would result in a larger area impacted by dust than under the other alternatives. Assuming a total of 1,046 miles of in-field gravel roads and 50.2 miles of airstrips, there is a potential for a total perimeter of 2,192 miles. Within 30 feet of gravel fill, up to 7,971 acres of vegetation could be subject to smothering by dust and gravel, and another 31,884 acres could be affected by a dust shadow.

Construction of gravel pads, roads, and airstrips could alter the moisture regime of tundra near the structure by changing natural drainage patterns and areas where snow accumulates. Snowdrifts caused by gravel structures increase the wintertime soil surface temperature and increase thaw depth in soils near the structures. These impacts are exacerbated by dust deposition (described above) and by the formation of impoundments (described below). These factors could combine to warm the soil, deepen thaw, and produce thermokarst adjacent to roads and other gravel structures (National Research Council 2003). Additionally, these changes could alter the species composition of the plant community near gravel structures. In general, most changes in the plant community around gravel structures would occur within 164 feet of the structure. If all effects were to occur within this zone, a maximum of 43,574 acres would be impacted under Alternative D (49 percent more than under Alternative A, 110 percent more than under Alternative B-1, 85 percent more than under Alternative B-2, and 8 percent more than under Alternative C). Note that this area includes the 39,855 acres affected by dust above, and is not in addition to it.

The construction of gravel roads into and within the NPR-A would provide a mechanism for the spread of non-native, invasive plants into the NPR-A. The effects of dust and gravel spray from the roads may also provide a substrate suitable for colonization of non-native, invasive plants. Oil and gas development in the NPR-A may cause, or accelerate, the invasion of the NPR-A by non-native, invasive plants. The potential for colonization by non-native, invasive plants could be reduced by pressure washing all equipment and vehicles before moving them into the NPR-A. This could effectively remove any seeds that wedge in cracks or crevices, or adhere to equipment or vehicles. Removing dirt from vehicles could also act to prevent potentially dangerous soil-borne pathogens or contaminants from being introduced to the NPR-A.

Material Sites

Gravel required for development in the NPR-A could be mined from existing sites east of the NPR-A, or could be extracted from new sites developed within the NPR-A. Investigations to identify gravel sources in the NPR-A have not been conducted except for existing discoveries, but presumably would be initiated if discoveries of recoverable oil or gas were made. Under Alternative D, it is assumed that up to 55 material sites would be needed. This would cover a total area of 2,088 acres (48 percent more than Alternative A, 107 percent more than Alternative B-1, 86 percent more than Alternative B-2, and 8 percent more than Alternative C). Excavation of gravel and stockpiling of overburden would destroy vegetation at these sites.

Pipelines

Under Alternative D, types of impacts from oil and gas pipeline construction would be similar in nature to those described for the other alternatives. The total area disturbed by each vertical support member would be about 15 square feet. About 6 percent of this area would be vegetation destroyed and replaced by the vertical support member, and the remaining portion would be potentially altered in terms of community type or species composition. Approximately 0.05 acre of vegetation would be disturbed per pipeline mile for oil-gathering pipelines, and 0.03 acres per mile of regional oil pipelines. Under Alternative D, 224 miles of gathering lines for oil and 594 miles of regional oil pipelines would disturb 27 acres of vegetation through vertical support member placement or the same as under Alternative A, 35 percent more than Alternatives B-1 and B-2, and the same as Alternative C. Ice roads built for construction of these pipelines would have short-term impacts to vegetation on less than 3,469 acres. In reality, some of the vertical support members for gathering lines would be over gravel pads and would have no impacts on vegetation, nor would ice roads be necessary for construction of these portions of pipeline. It is assumed that gas pipelines would be buried, so impacts to vegetation would be different than for oil pipelines. In the case of buried gathering, regional, and high-pressure gas pipelines, short-term disturbance from ice roads would affect 8,807 acres. Long-term impacts from trenching and spoils storage would occur on 3,775 acres.

Summer Tundra Travel

On a case-by-case basis, the BLM may permit low-ground-pressure vehicles to travel off gravel pads and roads during periods other than when the ground is frozen and covered with snow. This is expected to be an uncommon occurrence, and if permitted at all, it would likely be only during late summer to fall. Because of restrictions that would be placed on this activity, impacts to vegetation should be limited to the compression of standing vegetation, similar to what happens during winter following traffic by low-ground-pressure vehicles.

Air Pollution

The potential for impacts to vegetation from air pollution would be slightly greater under Alternative D than under the other alternatives, given the greater potential for gas fields and processing facilities.

Effects of Spills and Gas Releases

The greater amount of leasing, development, and production of oil and gas that would occur under Alternative D compared to the other alternatives, would result in a greater number of small spills of crude and refined oil, produced water and seawater in the NPR-A, and a larger number of gas releases due to the increased miles of regional gas pipelines assumed. The probability of a large oil spill occurring would also be slightly greater under Alternative D, but for analysis, the assumption remains at one large spill.

Most oil spills cover less than 500 square feet (less than 0.01 acre), although a pressured aerial mist may cover up to 145 acres (Ott 1997). (Such a spill is a very low probability event, occurring less than once out of the total spills expected throughout the life of this plan. Thus, its magnitude is not apparent in the following acreages.) If 11 percent of all oil spills would reach vegetation during summer, under Alternative D, this would mean 61 of the 556 crude and refined oil spills assumed to occur over the life of the plan would have more than a negligible effect on vegetation. Assuming the average spill would cover 0.1 acre, under Alternative D approximately 6 acres would be impacted substantially during the lifetime of development in the NPR-A. This is about the same as the acreage impacted under Alternatives A and C, and 50 percent more than under Alternatives B-1 and B-2. Overall, past spills on Alaska's North Slope have resulted in minor ecological damage and ecosystems have shown good potential for recovery (Jorgenson 1997). There are techniques that may accelerate the cleanup process after an oil spill (e.g., Yakubu et al. 2009).

A single gas release occurring with ignition could have thermal effects to approximately 194 acres of tundra vegetation (500-meter radius). The assumed number of gas releases under Alternative D (6.4 = 0.9 incidents per 300 pipe miles times 2,136 miles of pipe), if ignited, would result in thermal effects to approximately 1,242 acres of tundra. If a wildfire resulted, additional acreage would burn, the amount depending on season, weather conditions, moisture content of vegetation, and suppression effort. Most North Slope tundra fires are less than 1,000 acres (Racine and Jandt 2008). Total vascular plant cover following lightning-caused tundra fires reached 50–100 percent after 5 to 6 years (Racine et al. 1987). Lichens, however, could take several decades to recover, if they can achieve former densities at all under a climate-warming regime (Jandt et al. 2008).

Abandonment and Reclamation

During abandonment activities, vegetation and wetlands would be impacted by dust fallout along roads, by ice roads and other off-road tundra travel associated with dismantling of pipelines and power lines, and by disturbance to vegetation adjacent to vertical support members and power line poles during their removal. The level of impact from these activities would be roughly the same as that during construction if gravel fill was removed; impacts would be less if the gravel were to be left in place. If roads and pads were left in place, and especially if cross drainage across roads was not maintained, water impoundment would occur and could alter plant communities as described for the construction period. It is also likely that the unmaintained roads would have occasional washouts where tundra vegetation would be covered with washed-out gravel. Roads and pads, if left in place, would likely need to be revegetated with plants native to gravel bars and ridges in the Arctic (i.e., different from the plant communities surrounding the facilities). Revegetation activities could take several years, as initial attempts are not always successful. Removal of gravel from pads, roads, and airstrips could be mandated. Partial or complete removal of gravel can result in faster reestablishment of native plant growth, although establishment can take many years (more than a decade). In addition, thaw subsidence is difficult to predict, and complete restoration to preexisting conditions is improbable. In general, impacts from abandonment and reclamation for Alternative D would be greater than what would occur under the other alternatives, given the numbers of fields likely to be developed under each of these alternatives.

4.7.5.3 Effectiveness of Stipulations and Best Management Practices

Alternative D would have most of the lease stipulations and best management practices as outlined under Alternatives B-1, B-2, and C. The exceptions to this are that under Alternative D there would be no lease stipulations (K-3, K-7, K-8b, K-9 or K-10), and the restrictions under K-4a would be reduced. All of these stipulations affected where infrastructure could be placed in certain areas. Since the lifting of these restrictions under Alternative D could make more oil and gas economically recoverable, it is likely that more vegetation would be destroyed or disturbed under Alternative D than under the other alternatives. The best management practices and lease stipulations associated with Alternative D would reduce impacts by ensuring the minimum necessary destruction of vegetation and alteration of plant communities, given that infrastructure, would be permitted in various areas.

4.7.5.4 Conclusion

Under Alternative D, impacts to vegetation from activities other than oil and gas development would be essentially the same as those under the other alternatives. In most cases, the duration of the causes of these impacts would be short term, ranging up to 5 months, and recovery would vary from 1 to several years. Some impacts from snow machines and ATVs, where the same trail is followed continuously such as near villages, could be major (but localized) and would not recover as long as the traffic continues.

As for other alternatives, impacts to vegetation from oil and gas exploration under Alternative D would occur from seismic work and construction of well cellars during exploratory drilling and the construction of ice roads and ice pads. The duration and recovery time for impacts associated with seismic work would be similar to those for overland moves and the same as for the other alternatives. Based on earlier studies, there should be no substantial, long-term impacts to vegetation from seismic lines, but substantial impacts from camp move trails could remain on approximately 2,658 acres after 8-9 years. Effects of well cellar construction would also be permanent, but would impact only 0.4 acres of vegetation.

Under Alternative D, the effects of oil and gas development and operation would include destruction of vegetation during construction of gravel pads (central processing facilities and gas compressor facilities, satellite drill pads, pump and compressor stations, and staging bases), roads and airstrips; from excavation of material sites and burial of gas pipelines; construction of vertical support members; and the potential for colonization by non-native, invasive species. These impacts would be long-term, and would impact about 16,329 acres, or 0.07 percent of the 22.8-million-acre NPR-A (as compared to 0.04 percent under Alternatives A and B-2, 0.03 percent under Alternative B-1, and about the same as the 0.7 percent under Alternative C). Plant communities could also be altered by dust deposition, salinity of gravel fill used in construction, snowdrifts, and blockage of or change to natural drainage patterns. These impacts would also be long-term and would impact about 43,574 acres, or 0.2 percent of the NPR-A (46 percent more than the amount of vegetation impacted under Alternative A, 111 percent more than under Alternative B-1, 90 percent more than under Alternative B-2, or 6 percent more than under Alternative C).

It is assumed that impacts to vegetation types or communities would occur in proportion to their occurrence within the NPR-A. Since there are fewer restrictions on infrastructure under Alternative D than any other alternative, that assumption is more likely to hold true under Alternative D.

Areal extent of short-term impacts under Alternative D would be about 42 percent more than for Alternative A. Areal extent of long-term-term impacts under Alternative D would be about 65 percent more than for Alternative A. Impacts to vegetation from non-oil and gas activities, and from oil and gas activities, would likely be additive, as opposed to compensatory, except in those areas where the two types of activities overlapped. Impacts to vegetation from exploration and development activities would also be additive, except where development activities occurred in areas previously disturbed during exploration. In areas where two or more activities occurred, overall impacts would reflect those impacts associated with the first activity and any new impacts associated with later activities. As for Alternative A, recovery of tundra vegetation to its original composition from any of the above impacts may be delayed or precluded entirely as a result of simultaneous effects of climate change, i.e., increased shrub height and cover extent, decreased lichen and moss cover, increased thermokarst, and increased inundation of coastal areas by salt water. Such impacts of climate change could accumulate with any changes in soil thermal regimes that might occur as a result of past and future non-oil and gas and oil and gas activities in and near the NPR-A, potentially leading to synergistic impacts to vegetation.

4.7.5.5 Potential Mitigation Measure—Weed-Free Vehicles (new best management practice)

The objective and requirement or standard would be the same as those described in section 4.3.5.5 in Volume 2. The potential benefits and residual/unavoidable impacts would be similar to those described for Alternative A at section 4.3.5.5 in Volume 2.

4.7.6 Wetlands and Floodplains

4.7.6.1 Activities Not Associated with Oil and Gas Exploration and Development

Under Alternative D, impacts to wetlands and floodplains associated with non-oil and gas activities would essentially be the same as those described under Alternative A.

4.7.6.2 Oil and Gas Exploration and Development Activities

Various activities associated with oil and gas exploration, development, and production could impact wetlands and floodplains in the NPR-A. These activities include overland moves, seismic operations, exploration drilling, construction of ice roads, ice pads, ice airstrips, gravel roads, gravel pads for pump stations, central processing facilities, gas compressor facilities, and staging bases, airstrips, pipeline construction, gravel mine sites, and summer tundra travel.

Exploration

Under Alternative D, types of impacts to wetlands and floodplains from activities associated with oil and gas exploration would be similar to those described under Alternative A. There would be a greater number of exploration and delineation wells drilled for gas than under the other alternatives, which would alter the impacts of well cellar construction and the number and impacts of both ice pads and ice roads. There would be the same number of exploration and delineation wells drilled for oil as under Alternatives A and C, but 88 percent more than under Alternatives B-1 and B-2.

Under Alternative D, it is assumed there would be five more seismic surveys (one additional 2-D and four additional 3-D) than for Alternatives A, B-1, and B-2, and two additional 3-D surveys than for Alternative C. The overall total for surveys and camp moves would be 786,603 acres. Long-term disturbance (greater than 8 to 9 years) is estimated to total 2,658 acres.

During exploration, the additional wells drilled under Alternative D would result in 459,539 acres of short-term disturbance from ice roads, snow-packed trails, ice airstrips, and ice pads. Long-term disturbance would be negligible.

The construction of well cellars during exploration under Alternative D would amount to less than 0.4 acre.

Development and Production

During oil development and production, various activities could cause impacts to wetlands and floodplains in the NPR-A. These activities include construction of gravel pads for pump stations, staging bases and central processing facilities, roads, airstrips, pipelines, excavation of material sites, summer tundra travel, and construction of ice roads. Impacts of ice roads were discussed in Alternative A.

Construction of central processing facilities and gas compressor facilities, and associated satellite pads, roads, and airstrips, would result in the destruction of 10,439 acres of wetland vegetation in areas where gravel was placed.

Increased dust levels, due to the higher amounts of construction and facility use under Alternative D would result in a larger impact area than other alternatives. Impacts to plant communities around gravel structures would occur within 164 feet of the structure (Woodward-Clyde Consultants 1983). If all effects were to occur within this zone, a maximum of 39,855 acres would be impacted under Alternative D.

Gravel pit excavation and stockpiling of overburden would destroy wetlands at gravel-extraction sites. The location of gravel pits with an adequate distance from streams and lakes would minimize these impacts. Up to an estimated 55 gravel pits (2,088 acres) could be required for the Alternative D development scenario presented in Table 4-14 in Volume 2.

Under Alternative D, types of impacts from oil and gas pipeline construction would be similar to those described for other alternatives. A detailed discussion of impacts from pipelines to vegetation is in section 4.3.5.2. Alternative D could disturb up to 27 acres of vegetation through vertical support member placement. Ice roads built for construction of these pipelines would have only short-term impacts to vegetation, as described above for exploration activities, and would affect 3,469 acres. It is assumed that gas pipelines would be buried, so impacts to vegetation would be different than for oil pipelines. This short-term disturbance for gas-gathering lines, regional, and high-pressure gas pipeline would affect 12,582 acres. Total long-term impacts from gas pipeline burial would be 3,775 acres.

Low-ground-pressure vehicles may be permitted to travel off of gravel pads and roads during periods other than when the ground is frozen and covered with snow. This activity is commonly associated with pipeline inspections and spill prevention and preparedness measures required in spill prevention plans during the summer. Impacts under Alternative D would be similar to those described in Alternatives A, B-1, and B-2, and result in negligible short- and long-term impacts.

Effects of Spills and Gas Releases

A greater amount of leasing, development, and production of oil and gas that would occur under Alternative D compared to the other alternatives. This would likely result in a greater number of small spills of crude and refined oil, produced water, and seawater in the NPR-A, and a larger number of gas releases due to the increased miles of regional gas pipelines assumed. The probability of a large oil spill occurring would also be slightly greater under Alternative D, but for analysis, the assumption remains at one large spill.

An estimated 11 percent of all spills would occur in the summer and leave gravel pads. This would result in 61 small spills over the life of the plan in Alternative D. Assuming an average spill would cover 0.1 acre, an estimated 6 acres could be impacted over the period of development in Alternative C.

A single gas release occurring with ignition could have thermal effects to approximately 194 acres of tundra vegetation. The assumed number of gas releases under Alternative D would result in thermal effects to approximately 1,242 acres of tundra.

Abandonment and Reclamation

Under Alternative D, impacts to wetlands and floodplains associated with abandonment and reclamation of gravel roads and pads, pipelines, and other facilities would essentially be the same as those described under Alternative A. Alternative D would require approximately 14,241 acres to be rehabilitated, compared to Alternatives A (8,487 acres), B-1 (6,498 acres), B-2 (7,277 acres), and C (13,026 acres).

4.7.6.3 Effectiveness of Stipulations and Best Management Practices

Alternative D would have the same lease stipulations and best management practices as those outlined under Alternatives B-1, B-2, and C. The exceptions to this are that under Alternative D there would be no lease stipulations (K-3, K-7, K-8b, K-9, or K-10), and the restrictions under Stipulation K-4a would be reduced. All of these stipulations specify the placement of infrastructure in certain areas. Since the lifting of these restrictions under Alternative D could make more oil and gas economically recoverable, it is likely that more wetland vegetation would be destroyed or disturbed under Alternative D. The best management practices and lease stipulations associated with Alternative D would reduce impacts by ensuring the minimum necessary destruction of vegetation and alteration of plant communities, given that infrastructure would be permitted in various areas.

4.7.6.4 Conclusion

Under Alternative D, impacts to wetlands and floodplains from activities other than oil and gas would essentially be the same as those described under Alternative A.

Impacts to wetlands and floodplains from oil and gas exploration would occur from seismic work, construction of ice roads and ice pads, and construction of well cellars during exploratory drilling. The duration and recovery time for impacts associated with seismic work would be similar to those for overland moves. Based on earlier studies, there will be no long-term impacts to wetlands and floodplains from seismic lines, but camp move trails could substantially impact approximately 2,658 acres after 8 to 9 years. Effects of well cellar construction would also be long-term, but would impact less than 0.4 acre of vegetation.

The effects of oil and gas development and operation would include destruction of wetlands during construction of gravel pads (central processing facilities or gas compressor facilities, satellite drill pads, pump stations, and staging bases), roads, and airstrips, from excavation of material sites and burial of gas pipelines, and construction of vertical support members. These impacts would be long-term and would impact about 16,329 acres of the NPR-A. Plant communities could also be altered by dust deposition, salinity of gravel fill used in construction, snowdrifts, and blockage of or change to natural drainage patterns. These impacts would be also be long-term and would impact about 43,574 acres. Spills of oil, other chemicals, and saltwater could occur and would have long-term impacts, except for those associated with small-size spills, which would be cleaned up immediately, allowing recovery within a few years to two decades.

The potential for many shallow streams, ponds, and wetlands in the Arctic to dry out under a warming climate is increased by the loss of permafrost. These shallow systems depend on snowmelt as their primary source of water, with rainfall gains often negated by evapotranspiration during the summer. Evaporation from these shallow waterbodies is very likely to increase as the ice-free season lengthens. Hence, the water budget of most lake, pond, and wetland systems is likely to depend more heavily on the supply of spring meltwater from winter precipitation to produce a positive annual water balance, and these systems are more likely to dry out during the summer (ACIA 2004).

Climate change could alter species composition, increasing the prevalence of deciduous shrubs and decreasing the prevalence of wetland sedges and grasses, and could greatly influence wetlands through hydrological changes. Warmer soil temperatures are likely to increase thermokarst and increases in sea level may inundate low-lying tundra areas, increasing aquatic and wet tundra vegetation types and increasing coastal bluff erosion (ACIA 2004). Such climate change impacts could accelerate or exacerbate changes in soil thermal regimes that occur with oil and gas development, potentially leading to greater and/or cumulative impacts (Walker et al. 1987) to wetlands from changes associated with thermokarst.

Areal extent of short-term impacts under Alternative D would be about 42 percent more than for Alternative A. Areal extent of long-term-term impacts under Alternative D would be about 65 percent more than for Alternative A.

4.7.7 Fish

4.7.7.1 Activities Not Associated with Oil and Gas Exploration and Development

The potential types of effects on fish from non-oil and gas activities under Alternative D would be the same as those described for Alternative A in section 4.3.7.1 in Volume 2. Small camps, watercraft use, floatplane activity, and fisheries research could increase in association with the substantially greater extent of oil and gas activities projected to occur under Alternative D compared to the other alternatives. However, additional impacts to fish from this increase would likely be minor.

4.7.7.2 Oil and Gas Exploration and Development Activities

The following discussion addresses the potential effects of oil and gas activities on freshwater, anadromous, and marine fish and fish habitat found within the NPR-A under Alternative D.

Effects of Seismic Surveys

The potential types of effects on fish from seismic surveys under Alternative D would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2, except for Best Management Practice K-3b. In Alternative D, there is no comparable provision to Best Management Practice K-3b that would provide additional protection to the Kogru River, Dease Inlet, Admiralty Bay, Elson Lagoon, Peard Bay, Wainwright Inlet/Kuk River, and Kasegaluk Lagoon.

Under Alternative D, effects of seismic surveys on freshwater, anadromous, or marine fish should be localized and primarily impact individual fish in a specific lake or other overwintering location. It can be assumed that the more miles that are surveyed under any given alternative, the greater the probability that effects on fish may occur. The incidence of impacts on fish occurring from seismic surveys under Alternative D (77,562 surveying miles) would be 43 percent more than Alternative A, 33 percent more than Alternative B-1 and B-2, and 9 percent more than Alternative C.

Effects of Snow Trails, Ice Roads, Ice Pads, and Ice Airstrips

The potential types of effects on fish from snow trails, ice roads, ice pads, and ice airstrips under Alternative D would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2.

Under Alternative D, effects on freshwater, anadromous, and marine fish from snow trails, ice roads, ice pads, and ice airstrips, and the associated activities that take place on this temporary infrastructure, such as vehicle travel, industrial equipment transport and use, exploratory drilling, and supporting work camps, would likely be localized to a number of discrete locations. Across different alternatives, the anticipated length of ice roads and snow trails is a reasonable relative index of potential effects on fish from winter oil and gas activities. The greater the transportation network, the more supporting infrastructure and associated activities. From this perspective, the expected incidence of impacts on fish from winter oil and gas activities under Alternative D (108,734 ice road or snow trail miles) would be 41 percent more than Alternative A, 97 percent more than Alternative B-1, 83 percent more than Alternative B-2, and 6 percent more than Alternative C.

Effects of Water Demand

The potential types of effects on fish from water demand under Alternative D would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2.

Under Alternative D, considering the protective guidelines and the number of studies investigating both freshwater and seawater uses, effects of water demand on freshwater, anadromous, or marine fish should be limited to local, short-term impacts. In evaluating all alternatives, the relative comparison of projected ice infrastructure should be directly related to the expected incidence of impacts on fish from winter water use. Consequently, Alternative D (489,539 acres of ice pads, ice airstrips, and ice roads or snow trails) would have an incidence of impacts that is 50 percent greater than Alternative A, 110 percent greater than Alternative B-1, 50 percent greater than Alternative B-2, and 13 percent greater than Alternative C. The more production pads anticipated under an alternative, the greater the need for year-round freshwater for personnel camps. The degree of foreseeable impacts on fish from year-round domestic freshwater demand under Alternative D (161 oil and gas production pads) would be 56 percent more than Alternative A, 115 percent more than Alternative B-1, 96 percent more than Alternative B-2, and 9 percent more than Alternative C. The year-round need for seawater for waterflooding would be proportional to the number of oil production pads that would exist for an alternative. The probable extent of potential impacts on fish from year-round seawater use under Alternative D (16 oil production pads) would be the same as Alternative A, 14 percent more than Alternative B-1 and B-2, and 7 percent more than Alternative C.

Effects of Gravel Mining

The potential types of effects on fish from gravel mining under Alternative D would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2.

Considering the well-understood impacts associated with instream and floodplain gravel mining, regulations associated with this activity, and the generally positive results demonstrated in other North Slope oil field gravel mines, negative effects on freshwater, anadromous, or marine fish under Alternative D would likely be localized to small drainages where gravel pits are constructed. Foreseeable potential impacts on fish due to gravel mining would be proportional to the maximum number of gravel pits expected under each alternative. The extent of impacts under Alternative D (55 or fewer gravel pits) would be 38 percent more than Alternative A, 90 percent more than Alternative B-1, 77 percent more than Alternative B-2, and 6 percent more than Alternative C.

Effects of Development Pads, Roads, Airstrips, and Pipelines

The potential types of effects on fish from development pads, roads, airstrips, and pipelines under Alternative D would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2, except for Lease Stipulations K-3 and K-8b. In Alternative D, there are no comparable provisions to those stipulations that would provide additional protection to Teshekpuk Lake and the Kasegaluk Lagoon Special Area.

Under Alternative D, effects on fish from development pads, roads, airstrips, and pipelines, and associated activities such as vehicle and equipment traffic, personnel camps, and production drilling, should primarily occur in different areas at a small catchment scale;

impacts would not be expected to have a significant effect on larger watershed populations of freshwater, anadromous, or marine fish in the NPR-A or adjacent waters. The anticipated length of roads and pipelines is representative of the relative scale of expected development under each alternative. From this standpoint, the incidence of impacts on fish from those structures and associated activities under Alternative D (3,940 miles of roads and pipelines) would be 73 percent more than Alternative A, 108 percent more than Alternative B-1, 91 percent more than Alternative B-2, and 3 percent more than Alternative C. The incidence of impacts on fish related to gravel pads and airstrips under Alternative D (229 gravel pads and airstrips) would be 48 percent more than Alternative A, 102 percent more than Alternative B-1, 89 percent more than Alternative B-2, and 8 percent more than Alternative C.

Effects of Causeways

The potential types of effects on fish from causeways under Alternative D would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2, except for Lease Stipulation K-8b in Alternatives A, B-1, B-2, and C. In Alternative D, there is no comparable provision that would provide additional protection to the Kasegaluk Lagoon Special Area.

Under Alternative D, causeways or any other structures that extend into coastal waters could impact anadromous or marine fish along local coastline areas. Under the different alternatives, susceptibility to causeway effects can be based on the estimated length of coastline within available leasing areas for each alternative (Table 4-19 in Volume 2). From this perspective, 100 percent of the NPR-A coastline (1,200 miles) would be vulnerable to causeways under Alternative D. Comparatively, causeways could potentially be built along the entire NPR-A coastline under Alternative A except within Kasegaluk Lagoon, along less than 10 percent of the coastline under Alternative B-1 and B-2, and along 50 percent of the coastline under Alternative C.

Effects of Summer Tundra Travel

The potential types of effects on fish from summer tundra travel under Alternative D would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2.

Under Alternative D, limited summer tundra travel could affect freshwater or anadromous fish in a number of discrete lakes and streams, but would not likely have any impact on marine fish. Since most approved summer tundra travel would be related to pipeline maintenance, the length of pipelines estimated for each alternative is indicative of the relative extent of potential effects on fish from this activity. Accordingly, the expected incidence of impacts under Alternative D (2,894 miles of all pipelines) would be 83 percent more than Alternative A, 107 percent more than Alternative B-1, 93 percent more than Alternative B-2, and 2 percent more than Alternative C.

Effects of Oil Spills and Gas Releases

The potential types of effects on fish from oil spills and gas releases under Alternative D would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2, except for Lease Stipulations K-3 and K-8b. In Alternative D, there are no comparable provisions to those stipulations that would provide additional protection to Teshekpuk Lake and the Kasegaluk Lagoon Special Area.

Under Alternative D, effects on freshwater, anadromous, or marine fish from small crude or refined oil spills and from any gas release should typically be localized. Most gas releases would only present an acute, short-term threat to fish; impacts from liquid (oil and other produced fluid) spills would be much greater. Since most Alaskan North Slope industry spills have been contained on gravel pads and roads (National Research Council 2003), pipeline leaks would be the most likely source for spills that could affect fish. Consequently, the estimated extent of pipelines that would transport liquids under each alternative represents a practical relative risk to fish from small spills. The risk under Alternative D (2,484 miles of pipeline for oil and two- or three-phase produced fluids) would be 84 percent more than Alternative A, 135 percent more than Alternative B-1, 114 percent more than Alternative B-2, and 2 percent more than Alternative C.

Effects on fish from large oil spills, if a substantial portion reached freshwater, could impact freshwater and anadromous fish populations at a watershed level. If a considerable quantity of a large oil spill reached coastal waters, this could potentially impact anadromous or marine fish populations. The percent chance of one or more large oil spills (Table 4-16 in Volume 2) under Alternative D (39 percent) is more than Alternatives A (37 percent), B-1 (28 percent), B-2 (30 percent), and C (37 percent).

Effects of Abandonment and Reclamation

The potential types of effects on fish from abandonment and reclamation under Alternative D would be the same as those described for Alternative A in Volume 2. The best management practices and lease stipulations that would mitigate those effects are the same as those described for Alternative B-1 in Volume 2.

Effects (negative or positive) on freshwater, anadromous, or marine fish from oil and gas abandonment and reclamation under Alternative D should only occur at individual lakes, small stream reaches, or limited coastline areas. The total area of surface disturbance under the different alternatives should reflect the relative magnitude of potential effects on fish from abandonment and reclamation. As such, Alternative D (28,578 acres of permanent pads, roads, pipelines, and gravel pits) would have an expected incidence of impacts that is 72 percent more than Alternative A, 113 percent more than Alternative B-1, 94 percent more than Alternative B-2, and 4 percent more than Alternative C.

4.7.7.3 Effectiveness of Stipulations and Best Management Practices

The best management practices and lease stipulations under Alternative D would mitigate potential impacts on fish from oil and gas activities to the extent that effects would likely occur in localized areas and only a large oil spill would be expected to potentially affect fish at the population level. The effectiveness of these best management practices and lease stipulations would be the same as described under Alternative B-1 in section 4.4.7.3 in Volume 2.

4.7.7.4 Conclusion

The potential impacts to freshwater, anadromous, and marine fish from oil and gas exploration and development activities within the NPR-A under Alternative D broadly include acoustic disturbance, injury at water-use intakes, altered water quality, physical habitat changes (water quantity, flow patterns, and geomorphology), point and non-point source pollution, increased turbidity and sedimentation, and barriers to fish movements. These impacts can collectively contribute to reduced success at different life history stages, behavioral changes, diminished condition, susceptibility to pollutants or disease, shifts in fish species distribution, and mortality. The best management practices and lease stipulations in Alternatives B-1, B-2, C, and D, and the corresponding required operating procedures and lease stipulations in Alternative A would essentially provide the same level of protection to fish. The major exception is that Alternative D has no comparable provisions to Lease Stipulations K-3a and K-3b in Alternatives A, B-1, B-2, and C and Alternatives D and B-2 have no comparable provision to Lease Stipulation K-8b in the other alternatives.

The fundamental difference among the various alternatives regarding potential effects on fish is the extent of land that would be open for leasing to conduct oil and gas activities and the distribution of those lands within the NPR-A Fish Habitat Units (Map 3.3.4-1; Table 4-19 in Volume 2). Under Alternative D, NPR-A lands available for leasing include 34,100 miles of potential stream habitat. This is 92 percent more than Alternative A, 109 percent more than Alternative B-1, 97 percent more than Alternative B-2, and 33 percent more than Alternative C. The amount of potential lake habitat within lands that may be leased in Alternative D (1,879,400 acres of lake surface area) is 16 percent more than Alternative A, 86 percent more than Alternative B-1, 88 percent more than Alternative B-2, and 14 percent more than Alternative C. The distribution of these waterbodies in different NPR-A Fish Habitat Units is described in Table 4-19 in Volume 2.

If predicted shifts in physical and chemical characteristics of the environment occur with climate change (e.g., Scenarios Network for Alaska Planning 2010), impacts on fish from oil and gas activities under Alternative D could be greater or less than expected. The factors related to this are the same as those described for Alternative A.

4.7.7.5 Potential New Mitigation Measure (new best management practice)

The objective and requirement or standard would be the same as those described in section 4.3.7.5 in Volume 2. The potential benefits and residual or unavoidable impacts would be similar to those described for Alternative A in section 4.3.7.5.

4.7.8 Birds

This section discusses the potential direct and indirect effects to non-special status bird species that could result from management actions in the NPR-A under Alternative D; a discussion of effects to threatened and sensitive bird species is given in section 4.7.11, "Special Status Species." Most of the activities that could potentially affect birds in the planning area would result from oil and gas exploration and development. Other activities that could potentially affect birds in the planning area include permitted recreational use, guided hunting, activities associated with scientific surveys and research camps, cleanup of old oil and gas exploration sites, and activities associated with government actions (e.g., cleanup of abandoned well sites). These activities could affect tundra nesting birds by causing: (1) habitat loss, (2) disturbance or displacement, (3) increased predation, and (4) direct mortality. Impacts would most often be localized and on the scale of individual birds. Impacts have potential to have greater negative effect if the activity occurs in an area of high bird density (such as near lakes containing large numbers of molting geese or shorebird nesting and staging areas) or in areas containing populations of species known to have declining populations or those particularly sensitive to disturbance. Alternative D would make available 100 percent (22.8 million acres) of the NPR-A for oil and gas leasing, although leasing in lands currently deferred from leasing (see Alternative A) would not be offered for lease, pending expiration of the deferrals(Map 2-4). There would be no expansion of special areas, no new special areas would be designated, and the BLM would not recommend any rivers for Wild and Scenic Rivers designation. Management practices would emphasize performance-based stipulations and best management practices on surface activities, consultation with local residents, and coordinated scientific studies to protect wildlife habitat, subsistence use areas, and other resources.

4.7.8.1 Activities Not Associated with Oil and Gas Exploration and Development

Under Alternative D, activities not related to oil and gas exploration and development that could affect birds in the planning area would be the same as those described under Alternative A: air traffic, aerial surveys to inventory wildlife or other resources, summer research activities, hazardous material or debris removal, and permitted recreational camps and boating activity. As compared to Alternative A, impacts to birds from non-oil and gas activities could be more frequent, greater in extent, or longer in duration under Alternative D. This is because the greater amount of oil and gas activity projected in this alternative may increase the amount of non-oil and gas activity by increasing the impetus for scientific studies. More individual animals likely would be exposed to human activities, including aircraft traffic and aerial surveys. Impacts generally would be localized, and the disturbance reactions of birds would likely be brief. Some birds might avoid scientific and recreation camps during the 6 to 12 weeks of activities, while some birds (e.g., ravens) could be attracted to the camps. Best management practices (see Alternative A for specifics) would help to mitigate the potential effects of non-oil and gas activities on birds under Alternative D.

4.7.8.2 Oil and Gas Exploration and Development Activities

Exploration

Ground-based seismic surveys and exploration activities would occur during the winter months when birds are mostly absent from the NPR-A. Under Alternative D, the types of effects of winter exploration activities would be the same as those discussed under Alternative A. Approximately 30 percent more area would be covered by seismic surveys in Alternative D as compared to Alternative A, and the number of surveys would increase to 16 from the 11 estimated for Alternative A. The direct effects of ground-based exploration activities would likely include the temporary displacement of a small number of birds (e.g., ptarmigan and gyrfalcons) from preferred winter feeding or roosting areas.

Alternative D does not prohibit exploration activities in the same areas as Alternative A (i.e., in Dease Inlet, Admiralty Bay, Elson Lagoon, and associated islands). These areas are very important to many migratory species of waterbirds and shorebirds during critical life stages such as migration staging, molting, and breeding, and therefore, birds would suffer from the lack of protection. During winter exploration, indirect impacts could result from the construction of ice roads and ice pads, and the associated water withdrawal. The types of effects that could result from the construction and use of ice roads and ice pads would be the same under Alternative D as those described under Alternative A, and would primarily involve the temporary alteration of tundra habitats. Approximately 40 percent more area would be available to oil and gas exploration activities under Alternative D, as compared to Alternative A. Therefore, the potential impacts to birds resulting from exploratory activities would likely be greater under Alternative D than under Alternative A.

Of all the alternatives, Alternative D is projected to create the greatest amount of both long- and short-term surface disturbance. Alternative D contains the same measures as all other alternatives to avoid human-caused increases in predator populations. This includes Required Operating Procedure/Best Management Practice A-2 and Stipulation E-9, which would minimize the availability of anthropogenic food (e.g., garbage) and shelter, respectively that could be utilized by predators. Similarly, measures addressing proper handling of hazardous materials associated with the drilling process and accidental spills are the same among all alternatives as well (i.e., Required Operating Procedures/Best Management Practices A1 through A-7). Therefore, Alternative D offers no advantage or disadvantage to birds from the handling of waste products.

Under Alternative D, oil and gas exploration wells would create an estimated combined short-term ground disturbance of 768 acres, and a long-term ground disturbance of less than 1 acre. Delineation wells would impact the same number of acres, although not necessarily in the same locations as the exploration wells. Of all the alternatives, Alternative D is projected to create the greatest amount of short-term surface disturbance. There is essentially no long-term habitat loss predicted from exploration activities in any alternative.

Under Alternative D, moderate to large effects to birds could occur in the goose molting area, nearly 100 percent of which would be deferred from oil and gas leasing under Alternative A until 2018. Currently, there is little known as to why geese use the goose molting area in such large concentrations, and impacts to vegetation or impoundments and delayed drainage due to ice roads may have a negative effect on the habitat used by molting geese.

In Alternative D, the effects for the use of air guns for boat-based seismic work in Teshekpuk Lake during the summer would be the same as those in Alternative A, although the impacts may be greater in Alternative D as Teshekpuk Lake is not open for leasing in Alternative A as it is in Alternative D. Alternative D contains no comparable provision to Stipulations/Best Management Practice K3a and b, which provide protections to large areas of shorelines and barrier island habitats with the other alternatives.

Development and Production

Under Alternative D, the types of development and production activities would be the same as those discussed under Alternative A. In order to mitigate the potential negative effects of activities associated with the oil and gas development and production activities, Alternative D includes: Stipulations E-2, G-1, K-2, K-4a (providing much reduced protection compared to Alternatives B-1, B-2, and C), K-6 (provides a three-quarter-mile buffer as in Alternative A instead of a 1-mile buffer as in Alternatives B-1, B-2, and C), and K-11. The amount and location of activities could be different under Alternative D, thus effects to birds could also vary as discussed in detail below.

Habitat Loss

Of all activities, gravel mining and placement for the construction of oil and gas field infrastructure would have the greatest potential to result in the permanent loss of bird habitat. Under Alternative D, it is estimated that a total of 870 acres would be disturbed for oil central processing facilities and gas compressor facilities (see Table 4-14 in Volume 2). In conjunction with these facilities, other support structures would also be needed, such as gravel production pads, runways, and roads. Under Alternative D, the gravel footprint (total long-term disturbance) of these production facilities would be 16,329 acres (see Table 4-14 in Volume 2). Of all the alternatives, Alternative D is projected to create the greatest surface disturbance.

In addition to permanent habitat loss, temporary loss of tundra habitat adjacent to gravel roads and pads could occur as a result of thermokarst, dust deposition, snow accumulation, water withdrawals (if recharge does not occur), and impoundment formation. Under Alternative D, the types of effects to birds resulting from temporary habitat loss would be the same as those discussed under Alternative A. However, the potential for temporary loss would likely be greater under Alternative D than under any of the other alternatives due to the greater amount land available for leasing, likely resulting in an increased need for pads, pipelines, roads, and associated infrastructure. The extent of effects to birds from temporary habitat loss would depend on the species and numbers of individuals occurring in areas adjacent to the development.

Bird mortality could result from collisions with vehicles (ground and air) or structures such as elevated pipelines, buildings, drilling rigs, towers, power lines if suspended, boats (including barges), or bridges. Under Alternative D, the types of effects to birds resulting from collisions with structures would be the same as those discussed under Alternative A although the potential for collisions would be greater under Alternative D than under any of the other alternatives due to the greater amount land available for leasing, likely resulting in an increased need for pads, pipelines, roads, and associated infrastructure. The magnitude of potential impacts to bird populations as a result of collisions in areas of oil and gas development will depend, among other variables, on the location and type of the structure, the species involved, the lighting regime employed, and the weather conditions. Birds would likely be impacted at the level of the individual and not at a population level.

Disturbance

The potential for disturbance to birds from ground-based travel on roads, within pads, and cross-tundra would likely be greater under Alternative D than under Alternative A, because Alternative D would provide about 43 percent more lands available for oil and gas leasing (including a large tract of important bird habitat east of Dease Inlet, around Teshekpuk Lake and at Kasegaluk Lagoon and Peard Bay), likely resulting in an increased need for pads, pipelines, roads, and associated infrastructure. This area around Teshekpuk Lake is of international importance for molting brant and other geese, and the highest densities of nesting shorebirds in the planning area occur in areas northeast and northwest of Teshekpuk Lake. Potential impacts from summer cross-country travel on tundra would be limited in Alternative D, the same as all other alternatives, and would only be allowed on a case-by-case basis, and only after extensive studies have been conducted (Required Operating Procedure/Best Management Practice L-1).

Aircraft, both fixed-wing and helicopter, would provide access for oil and gas-related activities throughout the development, operation and abandonment of any oil or gas field developed in the NPR-A. The types of disturbance effects to waterfowl and other bird groups from aircraft would be the same under Alternative D as those discussed under Alternative A, and could include displacement from preferred feeding habitats, temporary or permanent nest abandonment, and temporary or permanent displacement from staging, molting, or brood-rearing areas. Aircraft disturbance would be likely to affect birds in those portions of the NPR-A open to development, with the effects being greatest in Alternative D.

The types of disturbance effects to waterfowl and other bird groups from watercraft would be the same under Alternative D as those discussed under Alternative A, and could include displacement from preferred habitats and nest abandonment. As the expected number of sealifts in Alternative D would be higher than in Alternative A, the impacts from bird collisions with barges would also be higher in Alternative D.

Oil spill response training activities using watercraft could be conducted on rivers and lakes several times during the summer. The potential for disturbance to birds from these activities would likely be greater under Alternative D than under Alternative A, due to the greater amount land available for leasing, likely resulting in an increased need for pads, pipelines, roads, and associated infrastructure. The extent of effects to birds from oil spill and gas release response activities would depend on the species and numbers of individuals occurring in areas within and adjacent to the impacted area.

There would be a greater likelihood for disturbance to molting waterfowl under Alternative D than under Alternative A, because as the largest of the molting areas would be deferred from leasing in Alternative A until 2018.

Predation

Some predators, such as ravens, gulls, arctic foxes, and bears could be attracted to areas of human activity where anthropogenic sources of food and denning or nesting sites were present. The potential impacts of increased numbers of predators on birds are discussed under Alternative A. Increased predation pressure could have moderate impacts on tundra-nesting birds. Under Alternative D, the types of effects to bird populations would be the same as those discussed under Alternative A. Under Alternative D, there would be greater potential for bird mortality due to predation than under any of the other alternatives, as there would be more human activity and anthropogenic sources of food available.

Abandonment and Reclamation

Development scenarios indicate that at abandonment of the field, gravel pads and roads may or may not be removed, and that reclaimed or abandoned pads may be revegetated by native vegetation or would be allowed to bed naturally. Given that scenario, it is very difficult to determine potential effects to birds from these unknown activities. For this document, it is assumed that all gravel will be removed after abandonment. Given that assumption, the impacts of abandonment and reclamation of oil and gas fields on birds would be similar in many respects to those incurred by construction activity. The types of impacts would be the same for Alternative D as described in Alternative A. Impacts would likely be greater for Alternative D than for any of the other alternatives as more area would be available for oil and gas development in Alternative D, resulting in a greater total area to be abandoned and subsequently reclaimed.

Oil Spills and Gas Releases

Under Alternative D, the types of and effects to birds from oil and seawater spills and gas releases would be the same as those discussed under Alternative A.

Although the estimated large spill volume is the same for all alternatives, the probability of a spill occurring varies little among Alternatives A, C, and D (37, 37, and 39 percent, respectively) while Alternatives B-1 and B-2 are estimated to have a 28 and 30 percent chance of a large spill, respectively. Even with the protection of particularly sensitive areas (e.g., coastal shoreline), and the substantial emphasis on spill prevention and response, if a large crude oil spill occurred, it could have a measurable effect on birds at a population level. The potential for disturbance to birds from an oil spill would likely be greatest under Alternative D, as compared to all other alternatives due to the smaller amount of area unavailable for leasing and the diminishment of protections existing in the areas which contain large numbers of birds and a greater estimated number of oil development pads, pipelines and associated infrastructure that would be constructed.

Effects to individual birds could range from short-term disturbance to death. Impacts to birds on a population level could occur if oil from a large spill entered rivers, important molting or brood-rearing lakes, or marine areas during periods when large proportions of specific populations (e.g., brant, long-tailed ducks, eiders, and shorebirds) were present. Many factors would determine the probability that birds would be negatively impacted by a large oil spill, including the quantity spilled, season, location (e.g., land versus water), and proximity to sensitive habitat. Although the probability of a spill varies by alternative, the impacts to individual birds from large crude or refined oil spills would be the same as under all alternatives if a spill were to occur in a location where birds were present.

Oil entering a river or stream could potentially spread into delta or coastal areas, where impacts to loons, waterfowl, and shorebirds could be more severe. Under all alternatives, the potential that an oil spill would enter a major river or stream would be minimized by Stipulation K-1. This would provide setbacks from specified rivers, within which permanent oil and gas facilities would be prohibited, although pipelines would not necessarily be prohibited in some of these areas.

Oil spilled (from a barge or support vessel) into marine habitats would have the potential to spread oil over a larger area than in terrestrial habitats due to winds and currents; therefore, birds found in marine habitats within NPR-A could be particularly susceptible to the negative impacts of an oil spill. The greater need for marine transportation under Alternative D, relative to all other alternatives, would increase the opportunity for a spill to occur. For further discussion of potential effects of marine spills, see Alternative A.

A gas release from a well is expected to last one day and to release 10 thousand cubic feet of gas, while a release from a transmission pipeline or processing facility is estimated to release 20 thousand cubic feet over a few hours. Although the estimated release volume is the same for all alternatives, the difference in the estimated number of gas production wells and lengths of various pipelines would change the probability of a release between the alternatives. The potential for disturbance to birds from a gas release would likely be greater under Alternative D, as compared to all other alternatives, due the smaller amount of area unavailable for leasing and the diminishment of protections existing in the areas which contain large numbers of birds and a greater estimated number of gas development pads, pipelines and associated infrastructure would be constructed.

4.7.8.3 Effectiveness of Stipulations and Best Management Practices

Alternative D makes 100 percent of the NPR-A available for oil and gas leasing, while retaining the four existing special areas and providing numerous surface protections. The current surface deferrals would be honored until expiration.

All alternatives including Alternative D contain numerous stipulations and best management practices that would effectively protect birds and their habitats in the NPR-A (see Alternative A for a full listing). The “B” best management practices would help limit the impact of water withdrawals on lakes, or lake habitats, used by birds, while the “C” required operating procedures govern seismic ground operations to prevent seismic activity-related disturbance to birds and provide protection for over-wintering fish and invertebrates, which are sources of food for many birds. The goose molting area within the Teshekpuk Lake Special Area is protected by Stipulation K-4a, which requires that roads be designed to minimize impacts to molting geese and is substantially less protective than K-4 and K-4a in the other alternatives. Stipulation K-11 would delineate the area north of Teshekpuk Lake into seven large tracts, and limits development to a maximum of 300 acres of permanent surface disturbance resulting from oil and gas development in each tract. This stipulation would limit the amount of surface disturbance within the area north and east of Teshekpuk Lake and would help to minimize impacts to waterfowl molting and brood-rearing habitats and movements of birds within the area. In addition, there are numerous best management practices and stipulations that regulate the types of activities that can occur near waterbodies, including rivers and streams; types of equipment that can be used; and types of exploration and development activities that can be conducted in the planning area, to protect birds and their habitats.

Finally, Alternative D provides stipulations and best management practices that provide protection to surface resources that are less restrictive than in other alternatives, and several stipulations common to all other alternatives to protect biological resources near Teshekpuk Lake would not apply in Alternative D. As there has been no oil or gas development yet in the NPR-A, it is difficult to determine the effectiveness of the above-mentioned best management practices and stipulations. Required operating procedures and stipulations that have been in effect in the NPR-A to date regulate exploratory activities, and thus far, seem to be effective in protecting birds and bird habitats.

4.7.8.4 Conclusion

Under Alternative D, 100 percent of the NPR-A's approximately 22.8 million subsurface acres could be offered in future oil and gas lease sales, though approximately 2 million acres of the available lands would remain deferred from leasing until 2014 or 2018. This alternative retains 8.3 million acres within four special areas. Alternative D would allow more infrastructure into areas of very high value to birds than any other alternative, and in this aspect, would be less protective than the other alternatives, and may result in increased habitat loss, disturbance, or mortality. A corridor for infrastructure associated with offshore development in the Chukchi Sea could be accommodated.

Non-oil and gas activities that could potentially affect birds would be the same as those in Alternative A. Under all alternatives, this analysis shows that impacts to birds from non-oil and gas activities would be minor.

The overall level of development likely to occur under Alternative D is greater than that under any other alternative. The potential for habitat loss and alteration to affect birds would be greatest under Alternative D, as the amount of high-use bird habitat that would be lost to gravel infrastructure would be greater, and there would be a higher potential for infrastructure to be located in areas of high bird use in the Teshekpuk Lake Special Area. Stipulations and best management practices established for Alternative D would help to mitigate potential impacts to birds.

Under Alternative D, the types of disturbances related to vehicle, aircraft, pedestrian, and vessel traffic, routine maintenance activities, heavy equipment use, facility noise, and oil spill and gas release cleanup activities would be similar to those described under Alternative A. Under Alternative D, types of impacts to birds would be similar to those discussed under Alternative A, but would be greater in frequency and extent because of the high oil and gas potential of the northern portion of the NPR-A, and the potential for greater development to occur, including in areas currently off-limits to surface-development activities. It is expected that impacts to birds in the vicinity of Teshekpuk Lake, and throughout the northern portion of the planning area, would be greater under Alternative D, particularly with respect to molting waterfowl, as none of the high-use bird habitat in the NPR-A is deferred from leasing after 2018.

The potential for bird mortality resulting from collisions with vehicles (air or ground) or infrastructure and marine vessel traffic would be greater under Alternative D, because the amount of infrastructure and barge traffic would be greater than under the other alternatives. The potential for an oil spill to impact birds would also be greater under Alternative D, as compared to the other alternatives, given the estimated greater amount of infrastructure and development activity in this alternative.

Stipulations and best management practices established under Alternative D would help to mitigate potential impacts to birds. Effectiveness of stipulations and best management practices are unknown at this time, but are presumed to be effective.

In general, impacts to birds from non-oil and gas activities, and from oil and gas exploration and development activities, would be additive. Potential impacts from seismic activity would vary by alternative with Alternative A expecting to require five exploratory and six developmental seismic surveys (see Table 4-11 in Volume 2). Alternative D is estimated to require 16 total seismic surveys, which will cover a greater area than would be needed under any other alternative. The expected number of oil and gas fields and the level of development under Alternative D would be greater than under any other alternative. Therefore, it is expected that the potential effects of disturbance, habitat loss and alteration, and bird mortality due to oil and gas exploration and development under Alternative D would be greater than under any other alternative. The sum of effects from all activities authorized under this alternative, barring a large oil spill, would likely produce no measureable effect on migratory bird populations of any species. All alternatives would minimize unintentional take of migratory birds and conserve migratory bird populations.

Although many of the forces driving global climate regime shifts may originate outside the Arctic, the impacts of global climate change are exacerbated in the Arctic (Arctic Climate Impact Assessment 2004). Temperatures in the Arctic have risen faster than in other areas of the world, as evidenced by glacial retreat and melting sea ice. Given that bird species whose range in Alaska is concentrated in the Arctic may be the most vulnerable to the effects of a changing climate. These species include: snow goose, king eider, red phalarope, stilt sandpiper, ruddy turnstone, pomarine jaeger, snowy owl, and Smith's longspur among others. Effects to birds from climate warming may include a suite of effects, both positive and negative. A longer open-water season may increase productivity of some species of shorebirds and increase productivity in aquatic and semi-aquatic systems, which provide food for many species of birds.

Warmer soil temperatures are likely to increase thermokarst, and increases in sea level may inundate low-lying tundra areas, increasing salt marsh, aquatic and wet tundra vegetation types, and erosion of coastal bluffs (Arctic Climate Impact Assessment 2004) causing changes in coastal habitats that may quickly result in changes in vegetation that influence habitat suitability and availability for birds (Mars and Houseknecht 2007). The increasing thickness of the active layer of soil above arctic permafrost is likely to cause changes in moisture regimes and the distribution of vegetation types over much of the Arctic in coming years.

Drying of wetlands would result in negative effects to those species that relay on shallow water and wet meadows, and shrub expansion may reduce the quality and availability of some types of habitats. Such impacts could accelerate or exacerbate changes in soil thermal regimes that occur with development, potentially leading to greater impacts to bird habitat. Melting sea ice may affect a few bird species, such as black guillemot that feed near the ice edge may not be able to bring high-quality food to their young as the pack ice moves farther offshore.

Increase in human economic activities such as shipping and offshore oil and gas development may influence the abundance and distribution of predators, which may negatively affect bird populations. These changes may be beneficial to some species such as those associated with boreal forest or shrub habitats, but a reduction in the amount of tundra habitat available could negatively impact tundra-nesting shorebirds and waterfowl, and add to the cumulative effects of oil and gas development. High rates of coastal erosion and storm surges have led to saltwater intrusion into freshwater habitats and such intrusions are expected to have altered goose foraging habitats and may be the cause of the observed spatial redistribution of geese in the Teshekpuk Lake Special Area (U.S. Geological Survey 2006).

4.7.9 Terrestrial Mammals

4.7.9.1 Activities Not Associated with Oil and Gas Exploration and Development

Impacts to mammals from non-oil and gas activities would essentially be the same as those discussed under Alternative A. No further analysis is necessary.

4.7.9.2 Oil and Gas Exploration and Development Activities

Under Alternative D, oil and gas leasing and exploration would be allowed on 100 percent of the NPR-A, although existing deferrals until 2014 and 2018, for the Kasegaluk Lagoon and Teshekpuk Lake areas, respectively, would be honored. In addition, lease stipulations would provide seasonal and spatial protection to certain environmentally sensitive areas, including Rivers Area, Deep Water Lakes, Colville River Special Area and Coastal Area, and the area north of Teshekpuk Lake. The exploration scenario under Alternative D assumes that two 2-D and fourteen 3-D seismic surveys would be conducted over the next 30 years, an increase of five surveys over Alternative A, and involving 68 percent more acreage than in Alternative A. It also assumes that 256 oil or gas exploratory or delineation wells, 31 percent more than those assumed under Alternative A, would be drilled from winter ice pads over that period. The development scenario under Alternative D assumes that 12 central processing facilities for oil and 42 central processing facilities or gas compressor facilities for gas, along with associated production pads and other facilities would be developed in the NPR-A. The exposure of terrestrial mammals to oil and gas activities, and therefore, the level of associated impact, would be greater under Alternative D than under all other alternatives, given that the overall scale of development is assumed to be greatest under Alternative D.

Effects of Disturbances

Seismic Activities

Impacts to terrestrial mammals would be greater than those discussed under Alternative A, since it is assumed that the number of terrestrial seismic operations would increase by 45 percent and would involve 68 percent more acreage. These could occur over the entire NPR-A. It is expected that the reactions of caribou and other terrestrial mammals to disturbance would be brief, and that a greater number of wintering Teshekpuk Caribou Herd caribou would likely be encountered, depending on the location of exploration activities (see Alternative A for a description of potential adverse impacts). Some caribou and other large mammals would likely be displaced from the general area of the seismic work. Some terrestrial mammals would avoid seismic camps, while others, such as foxes, could be attracted to the camps by food odors. The potential for disturbance to hibernating bears would be greater since seismic surveys under Alternative D could occur anywhere in the Utukok River Uplands Special Area, where bear density is greater. Impacts to moose would likely be greater than for

Alternative A, since the upper end of the Colville River area would be available for leasing and some NPR-A moose may winter there. Impacts to muskoxen would be greater, since there are known to be some mixed-sex groups in the reaches of the Utukok and Colville rivers which would be available for leasing.

Under Alternative D, Teshekpuk Lake would be available for leasing. Seismic exploration of the lakebed would likely require the use of air guns during the summer. This activity on the lake would likely cause only temporary displacement of terrestrial mammals near the lake. Displacement would occur primarily from the support activity associated with the surveys, such as helicopter flights to bring equipment to the lake. Once surveys were finished and the sources of disturbance had been removed, mammals would likely move back into the area around the lake.

Exploratory Drilling

Under Alternative D, it is projected that the number of exploration and delineation wells drilled (256) would be greater than for any of the other alternatives. Impacts to terrestrial mammals would be similar to those discussed under Alternative A, but greater in spatial extent, frequency and magnitude, as more exploration would occur. This is particularly so for the southwestern portion of the NPR-A, which would be excluded from leasing under Alternative A. Exploratory drilling would be conducted during the winter, when some mammal species are less active or less often present, although wintering Teshekpuk Caribou Herd caribou could be present in large numbers. Moose, muskoxen, and grizzly bears would experience a greater level of impacts than under Alternative A.

The implementation of lease stipulations and best management practices would minimize impacts to terrestrial mammals. These lease stipulations and best management practices would include provisions to avoid known grizzly bear dens by one-half mile, methods to avoid attracting wildlife to food and garbage, provisions to protect streambanks from damage during overland moves, provisions to minimize the effects of low-flying aircraft on wildlife (particularly over caribou winter ranges), and provisions to minimize the disturbance and hindrance of caribou in the Teshekpuk Caribou Herd and Western Arctic Herd Habitat Areas.

Oil and Gas Development

The entire NPR-A would be made available for oil and gas leasing under Alternative D. However, there is assumed to be no economically recoverable oil or gas in the two southernmost economic zones (see “Discovery and Development” in Volume 2), which include the upper Utukok and Colville rivers watersheds and the Brooks Mountains. These two zones would be available for lease, but this analysis assumes that there would be no development in them.

The primary effects of oil and gas development on terrestrial mammals would be similar in type to those outlined under Alternative A, but would be more frequent, greater in extent and possibly longer in duration. A greater number of individual animals would likely be exposed to human activities. Aircraft traffic would more often pass over caribou and other terrestrial mammals during flights, and more habitat would potentially be permanently lost. The impacts under Alternative D would also be greater than those for Alternatives B-1, B-2, or C.

Impacts would result from construction of facilities such as roads and pipelines; motor vehicle traffic within the oil and gas fields and on connecting roads; foot traffic near facilities and camps; aircraft traffic; crude-oil and fuel spills contaminating tundra, stream, and coastal habitats; and habitat alteration associated with gravel mining and construction. These impacts would be greater under Alternative D than under other alternatives, given the larger development scenario that would create more disturbance and directly affect about 65 percent more acres of habitat under long-term disturbance, as compared to Alternative A, and the availability for lease of the upriver end of the Colville River Special Area and all of the Utukok River Uplands Special Area. Functional loss of habitat would be greater than the actual development footprint. Wolfe (2000) suggested that when caribou in the Central Arctic Herd avoided areas within 2.5 miles of roads and pipelines, the functional habitat loss increased from 2 percent (the immediate footprint of roads and gravel pads) to 29 percent.

Construction of permanent roads within the NPR-A could increase access to the area and could increase public and subsistence hunting of terrestrial mammals if those roads were to connect to villages or the larger road system. Among ungulate species, caribou would be most impacted by increased access for hunting, but other species (moose in particular) may also be impacted, depending on the location of permanent roads. The overall number of animals taken may not increase dramatically since most hunting would be for subsistence, but roads could focus hunts in particular portions of the NPR-A. Hunting pressure and harvests have increased for many wildlife species near the Trans-Alaska Pipeline System since its construction, but have not produced adverse population effects (Trans-Alaska Pipeline System Owners 2001). It is unlikely that the more remote roads associated with oil and gas development in the NPR-A would have as great an effect on wildlife populations as occurred along the Trans-Alaska Pipeline System corridor.

Caribou – Although much of the construction associated with oil and gas development would occur primarily during winter, development would bring year-round facilities and activities to caribou range. If a field were developed in the area surrounding Teshekpuk Lake, production pads, pipelines, within-field roads, and other facilities would be located within areas used by the Teshekpuk Caribou Herd caribou for calving, insect relief, and wintering. A field development in the northern section of the NPR-A would also require a connector pipeline to link the oil field with facilities to the east, further affecting the Teshekpuk Lake area, and possibly impeding movements until the Teshekpuk Caribou Herd habituates to its presence (Person et al. 2007). Development in the Utukok Uplands would have similar effects on Western Arctic Herd caribou, except that caribou rarely use the area for wintering.

The types of impacts of field development on caribou would be similar to those outlined under Alternative A. The probability that a field would be developed within the calving and insect-relief grounds of the Teshekpuk Caribou Herd caribou is greater than for Alternative A, because fewer restrictions are placed on infrastructure development, making economic development more likely. Thus, impacts to Teshekpuk Caribou Herd caribou could be greater under Alternative D than under any other alternative. Wilson and Loya (2012) and Wilson (personal communication) suggest through their modeling efforts that the remaining high-quality calving habitat following development would be 75 percent (95 percent confidence interval: 67 to 82 percent) for Alternative D, slightly less than for Alternatives A and C, but significantly less than for Alternative B-1 or B-2. In addition, much of the calving and insect-relief areas for the Western Arctic Herd caribou would be available for leasing under Alternative D, so impacts to this herd would also be greater. Overall, the level of impact to either herd would depend on the specific location of any oil or gas field.

Development in caribou calving grounds could displace some calving animals within 2.5 miles of roads, leading to a functional loss of calving habitat. Some caribou movements during the insect-relief season (late June to mid-August) would likely be affected by pipelines and road traffic. Traffic could result in local disturbance and displacement of caribou within one to a few miles of the operations. A pipeline linking oil or gas fields in the NPR-A, with facilities at the Alpine and Kuparuk River fields, or directly to the Trans-Alaska Pipeline System at Pump Station 2, would result in the disturbance and displacement of some caribou during winter construction, due to vehicle traffic along ice roads and to air traffic. It is expected that these disturbances would be short term (but see Alternative A's discussion of potential effects of seismic operations) and occur within about one to a few miles of the pipeline corridor.

Oil and gas development within the NPR-A could introduce for the first time such infrastructure and activities into the winter range of a North Slope caribou herd (Teshekpuk Caribou Herd). Previously, no North Slope caribou herd has been exposed to oil or gas activities year-round. The Teshekpuk Caribou Herd has experienced seismic exploration and activities near villages for many years, and some herd members on the periphery of the range have been exposed to oil field facilities in some years, but there is no evidence as yet of adverse effects other than increased hunting mortality for those animals close to villages. It is not known what population effects might occur if the majority of the herd were to have year-round contact with oil and gas facilities and activities. Despite the current lack of evidence regarding adverse effects from seismic exploration and village contact, negative effects on caribou energy budgets during winter could result from this new situation. Such an effect could be manifested through increased winter mortality itself, or a reduction in calf productivity. The Western Arctic Herd has experienced some interference during migration and insect season from the Red Dog mine haul road, but Alternative D could potentially result in much more interference during those seasons. The Western Arctic Herd is still "naïve" in terms of interactions with infrastructure during the calving season. In general, Alternative D would have a higher probability of causing a population-level effect to either or both the Teshekpuk Caribou Herd and Western Arctic Herd.

Alternative D has the highest probability of resulting in development within the calving grounds of the Teshekpuk Caribou Herd. Therefore, Teshekpuk Caribou Herd caribou could be exposed to oil and gas development facilities and activities at a time of year when they are most sensitive to disturbance. A broad-scale analysis of resource selection functions for the Teshekpuk Caribou Herd (Wilson et al. in review) indicates that the landscape characteristics amenable to calving are primarily concentrated in the area north, east, and south of Teshekpuk Lake. Using this distribution of calving habitat, three hypothetical scenarios for oil and gas development in the northeastern portion of the NPR-A, and a method to discount habitat quality as a function of distance from infrastructure based on data from Cameron et al. (2005) and Wilson et al. (2011) showed that significant portions of high-quality calving habitat could be lost to the

Teshekpuk Caribou Herd as a result of development. This suggests that if Teshekpuk Caribou Herd females are displaced from part or all of the current calving area, parturient females would be unlikely to find similar areas elsewhere across their range. This situation could result in reduced calving success and negatively affect the Teshekpuk Caribou Herd at the population level. The level of calving habitat loss at which population-level effects would result remains to be determined.

Muskoxen – Muskoxen occur in low densities in the NPR-A. Potential effects of oil and gas development activities include displacement and disturbance of individual animals, direct habitat loss from gravel mining in river floodplains and placement of gravel at oil or gas field facilities, and indirect habitat loss through reduced access caused by physical or behavioral barriers created by roads, pipelines, and other facilities. Under Alternative D, impacts would be greater than those discussed under all other alternatives due to the larger overall development scenario. Development is assumed to be possible in more of the southernmost part of the NPR-A under Alternative D than Alternative C, because all of economic zones 220 and 230 (see section 4.2.1.2 in Volume 2.) would be available for lease. This makes development possible in more of what is currently the highest density muskoxen range in the NPR-A.

Moose – Moose occur in low densities in the NPR-A during the summer, and are concentrated in major drainages at the eastern edge of the NPR-A in the winter. Unless oil or gas fields were to be developed in the eastern portion of the NPR-A along the Colville River, development would be unlikely to have more than a minor impact on moose. Under Alternative D, impacts to moose would be similar to those that would occur under Alternative A, because the probability of development in the eastern portion of the NPR-A would be similar.

If gravel were mined from the eastern portion of the NPR-A, a temporary displacement and disturbance of moose could occur. Borrow pit operations could potentially destroy or degrade up to 2,088 acres of moose habitat if all gravel borrow operations occur in the eastern portion of the NPR-A (an unlikely scenario).

Dall Sheep – Dall sheep would not be affected by oil or gas development activities under Alternative D because the area in the two southernmost economic zones where sheep may occur is not assumed to hold economic deposits of oil or gas.

Grizzly Bears – Major sources of noise include construction of roads, installation of crude oil or gas pipelines, pump or compressor stations, gravel mining, and drilling operations. These activities could disturb grizzly bears within a few miles of the noise sources. Industrial activities and human presence could also cause potentially serious disturbances to denning bears. Under Alternative D, impacts to grizzly bears would be greater than those that would occur under Alternative A, because of the larger overall development scenario and the fact that all of the Utukok River Uplands Special Area and the westernmost portion of the Colville River Special Area would be available for leasing under Alternative D. Grizzly bears are present at low densities in the northern portion of the NPR-A, but could be attracted to some activities. It is likely that the greatest number of bears would be encountered during development activities in the southwestern portion of the NPR-A, since the greatest bear density occurs in this area.

Wolves – Under Alternative D, oil and gas development would have a greater impact on wolves than under Alternative A. Potential effects to wolves would include short-term disturbance from air and surface traffic and human presence, and increased hunting and trapping pressure through improved access or increased human presence associated with oil or gas development. If caribou abundance decreased substantially as a result of oil and gas development, wolf abundance could also decrease. Wolves are generally not abundant in the northern portions of the NPR-A, but achieve higher densities along the Colville River and especially in the southwestern portion of the NPR-A that would be available for leasing under Alternative D.

Wolverines – Similar to the other alternatives, under Alternative D, some wolverines could be displaced in the vicinity of oil or gas field facilities. Impacts under this alternative are likely to be greater than those that would occur under Alternative A, given the larger overall development scenario and because wolverines are thought to be at their highest densities in the southwestern portion of the NPR-A that would be available for leasing under Alternative D.

Foxes – Under Alternative D, impacts to arctic and red foxes would be similar to those under Alternative A, although they would likely be greater in spatial extent due to the greater development scenario. Oil and gas development activities could affect foxes by increasing the availability of food and shelter. An increase in the fox population associated with oil or gas development could affect some prey species of foxes (such as ground-nesting birds and molting waterfowl) in the development area and over a region larger than the oil field itself (Burgess et al. 1993).

Effects of Abandonment and Reclamation

Abandonment and reclamation activities are expected to disturb and displace terrestrial mammals in a manner similar to that associated with construction. The intensity of the disturbance might be less than during construction, however, because it is possible that caribou, muskoxen, and other terrestrial mammals would have become habituated to road and air traffic over the course of construction and operation of the facilities. Some individuals could be killed by collisions with road traffic. If roads were left in place and maintained in useable condition upon abandonment, they could continue to provide improved access to hunting areas, with consequent hunting pressure on caribou and other subsistence species. Revegetation of roads, pads, and airstrips, if left in place, would facilitate reclamation of habitat, but plant communities on these raised gravel structures would likely be different from those that prevail in adjacent areas and may include invasive species. Pads, roads, and airstrips could provide some insect-relief habitat for caribou, if left in place (Murphy and Lawhead 2000). If gravel fill were removed and the pad revegetated with species similar to the surrounding plant communities, caribou, and possibly other terrestrial mammals, would use the area. Foam insulating materials that could be used in pad construction could be broken up in the course of removal. If some of this foam escapes being cleaned up, it may be used by foxes as denning material. Depending on the material's toxicity and the amount ingested by a fox, this could cause mortality, though the numbers of foxes killed would likely be very small. Overall, a greater amount of development is assumed under Alternative D than under any of the other alternatives, providing a potential of greater impacts from abandonment and reclamation. Those impacts would likely be expressed over a similar time period, but result in no population-level effects from these activities in any case.

Effects of Spills and Gas Releases

Spills could involve crude oil, refined products, produced water, or seawater. Typical refined products that are spilled on the Alaska North Slope include aviation fuel, diesel fuel, engine oil, fuel oil, gasoline, grease, hydraulic oil, transformer oil, and transmission oil. The extent of environmental impacts would depend upon the type, location and amount of materials spilled or released, and the effectiveness of the response. The majority of small spills would be contained on the gravel pad and would have no impact on terrestrial mammals or their habitat. Gas releases could occur at well sites (i.e., over a gravel or ice pad) or from pipelines, the great majority of which would be over tundra.

The impacts of oil spills and gas releases on terrestrial mammals are described under Alternative A (section 4.3.9, "Mammals"). Compared to Alternative A, the risk of oil spills would be slightly greater under Alternative D. A total of one large spill is still assumed. The number of small spills assumed for Alternative D is slightly greater than for Alternative A: 5 percent more in number for both crude and refined oil spills and 5 percent more in volume for both types. Activities occurring in the vicinity of Teshekpuk Lake could increase the likelihood that a spill would reach the lake under Alternative D over that for Alternative A. Because most spills would be small and affect a small area, the majority of impacts to terrestrial mammals would likely result from disturbance associated with spill cleanup activities rather than direct oiling.

The assumed number of gas releases (6.4 incidents = 0.9 incidents per 300 pipe miles times 2,136 miles of pipe), if ignited, would result in thermal effects to approximately 1,242 acres of tundra. If a wildfire resulted, additional acreage would burn, the amount depending on season, weather conditions, moisture content of vegetation, and suppression effort.

4.7.9.3 Effectiveness of Stipulations and Best Management Practices

Most of the lease stipulations and best management practices developed to protect terrestrial mammals under Alternative D are essentially equivalent to the stipulations and required operating procedures designed to do the same under Alternative A. As such, they will provide the same benefits. Notable exceptions to this which increase protections are an addition to Best Management Practice E-8 to encourage storage and reuse of overburden and sod at material sites or other disturbed sites; the addition of Best Management Practice E-20 to aid in monitoring and assessing wildlife movements during and after construction of infrastructure; an addition to Best Management Practice F-1, and the addition of Stipulation K-12 to extend the flight restrictions and other protections covering the Teshekpuk Lake Caribou Habitat area to the Utukok Uplands Special Area; and improved control of ground traffic in Stipulation K-5. Notable differences from Alternatives B-1, B-2, and C that decrease protections in Alternative D are return of the setback along the Kogru River in Stipulation K-6 from 1 mile to three-quarters of a mile; removal of the prohibition on infrastructure in the Kasegaluk Lagoon Special Area in Stipulation K-8; removal of the restrictions on permanent infrastructure in the Caribou Movement Corridors in Stipulation K-9, and removal of the restrictions on permanent infrastructure in the Southern Caribou Calving Area in Stipulation K-10.

4.7.9.4 Conclusion

Under Alternative D, impacts to terrestrial mammals would be similar in type to those discussed under the other alternatives, but would be greater in frequency and extent because of the potential for greater development to occur, including in areas otherwise unavailable for leasing, and thus, off limits to surface development activities. Impacts would also be greater because there would be fewer restrictions on development of infrastructure in some areas. There would be an increase over all other alternatives in the likelihood of development occurring within caribou calving and insect-relief habitat.

It is expected that impacts to terrestrial mammals throughout the NPR-A, and especially in the vicinity of Teshekpuk Lake, would be greater under Alternative D than under other alternatives, particularly with respect to caribou calving and insect-relief habitat. Impacts would be slightly greater to Western Arctic Herd caribou, bears, wolves, wolverines, and muskoxen than under Alternative C, because more of the Utukok River Uplands Special Area would be available for leasing. For the same reason, impacts would be much greater for those species than under Alternatives A or B-1.

In general, impacts to mammals from non-oil and gas activities, and from oil and gas activities, would likely be additive, as opposed to compensatory, except possibly in those areas where both types of activities occurred simultaneously. Impacts to mammals from exploration and development activities would also be additive, except possibly for habitat impacts where development occurred in habitats previously disturbed during exploration. In areas where two or more activities occurred, overall impacts would reflect those impacts associated with the first activity and any new impacts associated with later activities. Based on the amount of habitat with a potential to be directly affected by actual development footprint, the magnitude of impacts to mammals under this alternative would be about 65 percent more than Alternative A. If oil and gas activities occurred in areas with an abundance of caribou or other mammals, or in areas with high-quality habitat, impacts could be greater than those based strictly on number of acres of habitat impacted due to disturbance effects. Alternative D has a higher probability of causing population-level effects to caribou or other terrestrial mammal species than Alternative A, B-1, B-2, or C, but that probability may still be low given the experiences of the Prudhoe Bay and Kuparuk oil fields.

As for the other alternatives, there will be impacts to terrestrial mammals from climate change (see section 3.3.6.8 in Volume 1) and from the oil and gas activities expected under Alternative D. Whether the combination of impacts from these two sources is additive or compensatory, or synergistic or countervailing, will depend on where and how development and climate change actually play out in the NPR-A. Climate change could make foraging more difficult for herbivores during winter, possibly causing negative, synergistic effects to mammals when combined with disturbance and displacement of mammals by oil and gas activities. Geographic shifts in the vegetation communities of the NPR-A as a result of climate change could have synergistic impacts to mammals if they resulted in a greater proportion of higher quality habitat for any season overlapping with areas of concentrated oil and gas activity. Alternatively, these vegetation community shifts could move important habitat out of the areas affected by oil and gas activity, resulting in a countervailing effect. Climate change may increase the availability of suitable habitat for some species (e.g., shrub habitat for moose), but may reduce suitable habitat for other species. For any terrestrial mammals affected in the latter way, it is likely that adverse impacts of climate change will be additive to any adverse effects of oil and gas activities, and the two combined may have synergistic adverse effects; any such additive effects would be greatest under Alternative D.

4.7.9.5 Potential New Mitigation Measures

Potential Mitigation Measure 1 – Hazing by aircraft (new subparagraph to Best Management Practice F-1)

The objective and requirement/standard would be the same as those described in section 4.3.9.5 in Volume 2 for Potential Mitigation Measure 1 – Hazing by aircraft. The potential benefits and residual/unavoidable impacts would be similar to those described for Alternative A at section 4.3.9.5

Potential Mitigation Measure 2 – Chasing wildlife with ground vehicles (new best management practice)

The objective and requirement/standard would be the same as those described in section 4.3.9.5 in Volume 2 for Potential Mitigation Measure 2 – Chasing wildlife with ground vehicles. The potential benefits and residual/unavoidable impacts would be similar to those described for Alternative A at section 4.3.9.5.

4.7.10 Marine Mammals

4.7.10.1 Activities Not Associated With Oil and Gas Exploration and Development

Baleen Whales

Effects of activities not associated with oil and gas exploration and development on gray and minke whales would be similar to the other alternatives.

Toothed Whales

As with Alternatives A, B-1, B-2, and C, the impacts on belugas whales, narwhals, harbor porpoise, and killer whales from activities within the NPR-A not related to oil and gas exploration and development would include air traffic; aerial surveys to inventory wildlife or other resources; summer research camps; hazardous material or debris removal; and recreational camps and boating activity. The effects of Alternative D would be similar to the other alternatives.

Ice Seals

Aircraft and vessel traffic are the non-oil and gas activities most likely to have a direct impact on spotted and ribbon seals. The potential effects of these activities are described under Alternative A. Impacts from activities not associated with oil and gas exploration and development would not differ from those described under Alternatives A, B-1, B-2, or C and would be negligible.

4.7.10.2 Oil and Gas Exploration and Development Activities

Baleen Whales

The types of effects to gray and minke whales from oil and gas exploration under Alternative D would be similar to the other alternatives, although the likelihood and magnitude of potential effects may be greater. With maximum acreage available for leasing and only one marine Special Area (Kasegaluk Lagoon Special Area), there could be more barge activity, more aircraft flights, and more noise imparted to the marine environment through exploration and production activities

Seismic Activities

Effects from onshore seismic surveys would be similar to the other alternatives and expected to have behavioral effects to only a small number of cetaceans since most surveys would take place onshore or during periods when whales are absent. Seismic surveys in nearshore lagoons and bays during the open water season could result in disturbance effects on gray whales feeding in the northeast Chukchi Sea, as described under Alternative A in section 4.3.10.2 in Volume 2. Few gray whales occur east of Barrow and minke whales, occasionally seen farther offshore in the Chukchi Sea, have not been reported in the Beaufort Sea. Although some individual gray whales may be temporarily disturbed by coastal seismic activities, population-level impacts are unlikely.

Shipping

Effects from shipping under Alternative D may be proportionately greater because of the increased acreage available for leasing and presumably more oil and gas activity in the NPR-A. The one marine Special Area (Kasegaluk Lagoon Special Area) could result in fewer nearshore barge transits in that location and less noise imparted into adjacent marine waters. However, it seems likely the Cape Simpson, Lonely and Point Franklin, areas where gray whales are known to feed, may be used as staging areas and that effects from shipping could occur. Ship/whale collisions are expected to be relatively rare, but are most likely to take place under Alternative D.

Toothed Whales

Oil and gas exploration, development, and transport activities within the NPR-A could impact beluga whales, harbor porpoises, narwhals, and killer whales in a manner similar to Alternative A. Those would include disturbance from anthropogenic sounds, ship strikes, or habitat degradation. Sound would be produced by vessels and aircraft, seismic operations, construction of facilities close to the coast, or production and transport of oil or gas. Vessels supporting activities in the NPR-A could strike toothed whales, causing injury or death.

Oil and gas activities under Alternative D would likely be higher and protections are fewer than under the other alternatives. More acreage would be available for leasing and fewer protections for many of the coastal waterbodies are included. If there is more oil and gas activity with more leases as assumed in section 4.2.1.2 in Volume 2, there might be an increase in aircraft use within the NPR-A, more barge activity to transport exploration equipment to the NPR-A for use in the winter, and possibly more seismic surveys. If this occurs, more individual whales may be exposed to increased anthropogenic sounds, increasing the possibility of deflection from preferred areas. This is more likely for beluga whales that more numerous and also known to congregate in coastal waters adjacent to NPR-A. There would also be an increased possibility of ship strikes.

Impacts from oil and gas activities in Alternative D would likely be higher than for the other alternatives. Even though the impacts would be expected to be higher, impacts to belugas, narwhals, harbor porpoises, and killer whales would still be small because most of the activity would occur at inland locations or during winter for coastal waterbodies.

Ice Seals

Potential types of direct and indirect effects on spotted and ribbon seals from activities authorized under Alternative D do not differ from those described under Alternative A. Oil and gas-related effects, however, would likely be more pronounced than those disclosed under Alternative A and all other alternatives. Alternative D would open all coastal areas to leasing after deferrals expire (Map 2-4). This increases the possibility of production oil spills directly into several important marine waters, and may expose spotted seals to other direct impacts as well, including disturbances at terrestrial haulouts. The chance for an onshore spill to reach marine waters may be more effectively minimized under this alternative relative to Alternative A due to the inclusion of twice as many rivers with setbacks in the K-1 Stipulation, and more coastal areas included in development restrictions of Stipulation K-6. Both species would still be sensitive to refined oil spills and discharge related to shipping traffic in support of onshore activities. Stipulations K-3b and K-8, present in some form for all other alternatives, do not exist in Alternative D. Absence of K-3b may create enhanced effects from less restricted exploration and development activities in major coastal waterbodies. Seals in Kasegaluk Lagoon would not receive protections through Stipulation K-8 or special area designation. Spotted seals may also be affected by aircraft flights and marine traffic near terrestrial haulouts the same as in Alternative A.

4.7.10.3 Effectiveness of Stipulations and Best Management Practices

Baleen Whales

The effectiveness of stipulations and best management practices would be similar to that of the stipulations and required operating procedures in Alternative A, although may offer less protection because Stipulation K-3b would not apply.

Toothed Whales

The effectiveness of stipulations and best management practices, as they relate to beluga whales, narwhals, harbor porpoises, and killer whales are similar to the stipulations and required operating procedures in Alternative A, although may offer less protection because Stipulation K-3b would not apply under Alternative D.

Ice Seals

Provisions for areas deferred until 2014 and 2018 would be effective at minimizing impacts to spotted and ribbon seals within these areas until the expiration of the deferrals. The stipulations and best management practices of Alternative D, as they relate to ice seals, are similar to the required operating procedures and stipulations in Alternative A. Notable exceptions are Stipulations K1 and Best Management Practice C-1. In Alternative D, Stipulation K1 would more effectively minimize the chance that an onshore oil spill would reach marine waters by including twice as many rivers as what are named in Alternative A (i.e., Alternative D uses the same list as Alternatives B-1, B-2, and C). Best Management Practice C-1 is made more effective in this alternative than in Alternative A, due to the explicit requirement for operators to conduct a survey to detect (and then avoid) seal birthing lairs for activities during the seal pupping season (through April 15). As with all other alternatives, discharge from support vessels may not be effectively regulated through the A-series required operating procedures, and could result in impacts to both species. Also, the same as other alternatives, overflights restrictions in Best Management Practice F-1 are not specifically managed to avoid marine mammals; however, Alternative D completely lacks Stipulation K-3b, which conferred some potential to reduce aviation impacts in all of the other alternatives.

Alternative D lacks comparable stipulations to those found under the other alternatives as Stipulation K-3b and K-8. K-3b under the other alternatives provided various restrictions on exploration and development activities in named coastal waterbodies. These restrictions minimized many potential disturbances to ice seals, as well as decreased the potential for a spill directly into important marine habitats. Therefore, the combined sum of stipulations in Alternative D are less effective in protecting ice seals for oil and gas development activities relative to the other alternatives.

4.7.10.4 Conclusion

Baleen Whales

Under Alternative D, most impacts will be associated with marine shipping and barging. Most of the associated impacts to baleen whales are related to marine noise, but ship/whale collisions are a possibility, particularly under Alternative D. Even with increased activity, population-level effects to gray and minke whales are unlikely.

Toothed Whales

Impacts from non-oil and gas activities to Arctic toothed whales will be the same under all alternatives. Impacts to belugas, narwhals, harbor porpoises, and killer whales from oil and gas activities under Alternative D would be higher than the other alternatives because of the increased acreage being offered for lease and reduced protection of coastal waters from leasing. Impacts would likely still be short term because most of the activity would occur inland or during winter for coastal areas. The most likely impact to belugas would be displacement from preferred habitats or disturbance to normal behavior due to anthropogenic sounds. These impacts would likely be localized and temporary, with population-level effects unlikely.

Ice Seals

Under Alternative D, the most likely effect to spotted seals from non-oil and gas-related activities would be haulout disturbance by aircraft and marine vessel traffic. Nonetheless, this will likely be low in intensity and short-term. Ribbon seals are unlikely to be affected by non-oil and gas activities due to their pelagic nature. Impacts to spotted seals from oil and gas activities will be similar to non-oil and gas activities, but will also include the chance of an accidental large or very large contaminant spill, possible reduction in prey resources if nearshore and riverine fish species are affected, and higher potential for the introduction of pathogens from increased marine vessel traffic. These impacts have the potential to negatively impact spotted seals that use areas adjacent to and within the NPR-A planning area. Due to their absence from the nearshore area, ribbon seals are only likely to experience adverse effects from large contaminant spills or the introduction of new pathogens to the system.

Climate change effects, when coupled with development, could have increased adverse effects for these species, particularly under Alternative D. Ice seals, if already stressed by sea-ice habitat loss due to climate change, may be more vulnerable to effects of oil and gas activities. How either species will deal with changes in sea-ice conditions is speculative. Spotted seals have the capacity to adapt and use other haulout substrates such as terrestrial areas. Such a change, however, would put them at greater risk to onshore disturbances. Due to the lack of unavailable designations and Special Areas under Alternative D, there could be more development in coastal areas than in the other alternatives, and this could exacerbate potential stresses on spotted seal populations from climate change. The effect of development coupled with effects of climate change could have a negative impact on spotted seals within and adjacent to the NPR-A planning area. Ribbon seals, an ice-dependent pelagic species may be less vulnerable to the combined effects of sea-ice changes and oil and gas development activities.

4.7.10.5 Potential New Mitigation Measures

Potential Mitigation Measure 1-- Aircraft Avoidance of Seal Aggregations (Addition to F-1 Best Management Practice)

The objective and requirement/standard would be the same as those described in section 4.3.10.5 in Volume 2 for Potential Mitigation Measure 1— Aircraft Avoidance of Seal Aggregations. The potential benefits and residual/unavoidable impacts would be similar to those described for Alternative A at section 4.3.11.5.

Potential Mitigation Measure 2—Marine Vessel Avoidance of Terrestrial Aggregations of Seals (Addition to K-6 Stipulation - Coastal Area)

The objective and requirement/standard would be the same as those described in section 4.3.10.5 in Volume 2 for Potential Mitigation Measure 2— Marine Vessel Avoidance of Terrestrial Aggregations of Seals. The potential benefits and residual/unavoidable impacts would be similar to those described for Alternative A at section 4.3.11.5.

4.7.11 Special Status Species

The following discussion of impacts is divided into four sections that discuss special status species of plants, birds, terrestrial mammals, and marine mammals.

Within each subsection, authors describe impacts of non-oil and gas activities and oil and gas activities and the effectiveness of stipulations and required operating procedures and then provide a conclusion (where the discussion is long enough to warrant one). All potential new mitigation measures for special status species are discussed at section 4.3.11.5 in Volume 2.

4.7.11.1 Special Status Species of Plants

Nine plant species listed as BLM Sensitive Species and their habitats are described in section 3.3.8 in Volume 1. All of these have been found within the outer boundaries of the NPR-A. An additional 12 species designated as sensitive by BLM-Alaska have been documented on the North Slope, but have not yet been documented in the NPR-A. The types of impacts to these plant species are the same as those for all other vegetation. These impacts are described in section 4.7.5, and are not repeated here.

Under Alternative D, development would be unlikely to affect any plant species' existence or any plant communities at scales larger than local effects. However, if development facilities were constructed in an area containing a population of a BLM Sensitive plant species (by definition rare), the impacts to that population, and thus, the species could be severe. Some of the habitats potentially occupied by sensitive species would be protected from development under Alternative D by setbacks along rivers and lakes. Other species occur in dry habitats associated with bluffs, floodplains, river terraces, sand dunes, rocky outcrops, and fellfields. These habitats are the primary sources of gravel fill used during construction and development (National Research Council 2003) and could be impacted by development in these areas.

4.7.11.2 Special Status Species of Birds

This section discusses the potential direct and indirect effects to threatened, endangered, and sensitive bird species that could result from management actions in the NPR-A under Alternative D. This includes yellow-billed loon, spectacled eider, Steller's eider, Kittlitz's murrelet, red knot, short-eared owl, and golden eagle (collectively referred to as special status species below). All of these species are migratory and do not occur in the NPR-A during winter.

Most of the activities that could potentially affect these special status birds in the NPR-A would result from oil and gas exploration, development and transport.

Other activities that could potentially affect birds include permitted recreation, guided hunting, activities associated with scientific surveys and research camps, cleanup of oil and gas exploration sites, and activities associated with government actions (e.g., cleanup of abandoned well sites). These activities could affect tundra-nesting special status birds by causing: (1) habitat loss; (2) disturbance or displacement; (3) increased predation; and (4) direct mortality. Impacts would most often be localized and on the scale of individual birds.

Alternative D would make available 100 percent (22.8 million acres) of the NPR-A for oil and gas leasing although leasing in lands currently deferred from leasing (see Alternative A) would not be offered for lease, pending expiration of the deferrals (Map 2-4). There would be no expansion of Special Areas, no new Special Areas would be designated, and BLM would not recommend any rivers for Wild and Scenic Rivers designation. Management practices would emphasize performance-based stipulations and best management practices on surface activities, consultation with local residents, and coordinated scientific studies to protect wildlife habitat, subsistence use areas, and other resources.

Activities Not Associated with Oil and Gas Exploration and Development

Under Alternative D, activities not related to oil and gas exploration and development that could affect special status species in the planning area would be the same as those described under Alternative A: air traffic; aerial surveys to inventory wildlife or other resources; summer research activities; hazardous material or debris removal; and permitted recreational camps and boating activity. As compared to Alternative A, impacts to special status species from non-oil and gas activities could be more frequent, greater in extent, or longer in duration under Alternative D. This is because the greater amount of oil and gas activity projected in this alternative may increase the amount of non-oil and gas activity by increasing the impetus for scientific studies. More individual animals likely would be exposed to human activities, including aircraft traffic and aerial surveys. Impacts generally would be localized, and the disturbance reactions of special status species would likely be brief. Some special status species might avoid scientific and recreation camps during the 6 to 12 weeks of activities, while their predators (e.g., ravens) could be attracted to the camps. Best management practices and large areas in which new non-subsistence permanent infrastructure is prohibited protect birds and their habitats and would help to mitigate the potential effects of non-oil and gas activities on special status species under Alternative D.

Oil and Gas Exploration and Development Activities

Exploration

Ground-based seismic surveys to collect geological data and exploration activities occur during the winter months when special status species are absent from the NPR-A. Therefore, these activities would likely have no direct impacts on these species. Under Alternative D, the types of effects of winter exploration activities would be the same as those discussed under Alternative A. Approximately 30 percent more area would be covered by seismic surveys in Alternative D as compared to Alternative A, and the number of surveys would increase to 16 from the 11 estimated for Alternative A. The direct effects of ground-based exploration activities would likely include the temporary displacement of a small number of birds (e.g., ptarmigan and gyrfalcons) from preferred winter feeding or roosting areas.

Alternative D does not prohibit exploration activities in the same areas as Alternative A (i.e., in Dease Inlet, Admiralty Bay, Elson Lagoon, and associated islands). These areas are very important to many special status species during critical life stages such as migration staging, molting, and breeding, and therefore, birds would suffer from the lack of protection. During winter, when exploration activities would be allowed (but no special status species are present), indirect impacts could result from the construction of ice roads and ice pads, and the associated water withdrawal. The types of effects that could result from the construction and use of ice roads and ice pads would be the same under Alternative D as those described under Alternative A, and would primarily involve the temporary alteration of tundra habitats. Water withdrawal for ice road construction could also temporarily alter habitats adjacent to water source lakes, which could affect nesting or brood-rearing loons and eiders. Approximately 40 percent more area would be available to oil and gas exploration activities under Alternative D, as compared to Alternative A. Therefore, the potential impacts to special status species resulting from exploratory activities would likely be greater under Alternative D than under Alternative A.

Of all the alternatives, Alternative D is predicated to create the greatest amount of both long- and short-term surface disturbance. Alternative D contains the same measures as all other alternatives to avoid human-caused increases in predator populations. This includes Required Operating Procedure/Best Management Practice A-2 and Stipulation E-9, which would minimize the availability of anthropogenic food (e.g., garbage) and shelter, respectively that could be utilized by predators. Similarly, measures addressing proper handling of hazardous materials associated with the drilling process and accidental spills are the same among all alternatives as well (i.e., Required Operating Procedures/Best Management Practices A-1 through A-7). Therefore, Alternative D offers no advantage or disadvantage to special status species from the handling of waste products.

Under Alternative D, oil and gas exploration wells would create an estimated combined short-term ground disturbance of 1,248 acres, and a long-term ground disturbance of less than 1 acre. Delineation wells would impact the same number of acres, although not necessarily in the same locations as the exploration wells. Of all the alternatives, Alternative D is predicted to create the greatest amount of long-term surface disturbance. There is essentially no long-term habitat loss predicted from exploration activities in any alternative.

After the expiration of the 2018 deferral, under Alternative D, moderate to large effects to special status species could occur in the goose molting area.

Development and Production

Under Alternative D, the types of development and production activities would be the same as those discussed under Alternative A. In order to mitigate the potential negative effects of activities associated with the oil and gas development and production activities Alternative D includes: Stipulations E-2, G-1, K-2, K-4a (providing much reduced protection compared to Alternatives B-1, B-2, and C), K-6 (provides a three-quarter-mile buffer as in Alternative A, instead of a 1-mile buffer as in Alternatives B-1, B-2, and C), and K-11. The amount and location of activities could be different under Alternative D, thus effects to special status species could also vary, as discussed in detail below.

Habitat Loss. Of all activities, gravel mining and placement for the construction of oil and gas field infrastructure would have the greatest potential to result in the permanent loss of habitat for short-eared owl, yellow-billed loon, and spectacled and Steller's eiders. Under Alternative D, it is estimated that a total of 900 acres would be disturbed for oil central processing facilities and gas compressor facilities (see Table 4-14 in Volume 2). In conjunction with these facilities, other support structures would also be needed, such as gravel production pads, runways, and roads. Under Alternative D, the gravel footprint (total long-term disturbance) of these production facilities would be 17,132 acres (see Table 4-14 in Volume 2). Of all the alternatives, Alternative D is predicted to create the greatest surface disturbance.

In addition to permanent habitat loss, temporary loss of tundra habitat adjacent to gravel roads and pads could occur as a result of thermokarst, dust deposition, snow accumulation, water withdrawals (if recharge does not occur), and impoundment formation. Under Alternative D, the types of effects to special status species resulting from temporary habitat loss would be the same as those discussed under Alternative A. However, the potential for temporary loss would likely be greater under Alternative D than under any of the other alternatives due to the greater amount land available for leasing, likely resulting in an increased need for pads, pipelines, roads, and associated infrastructure. The extent of effects to special status species from temporary habitat loss would depend on the species and numbers of individuals occurring in areas adjacent to the development.

Mortality to special status species could result from collisions with vehicles (ground and air), structures such as elevated pipelines, buildings, drilling rigs, towers, power lines if suspended, boats (including barges), or bridges. Any species of bird may be vulnerable to collision under certain circumstances (see Alternative A); in fact, it is one of the few ways that golden eagle, short-eared owl, Kittlitz's murrelet, or red knot could potentially be impacted under any alternative. Under Alternative D, the types of effects to special status species resulting from collisions with structures would be the same as those discussed under Alternative A although the potential for collisions would be greater under Alternative D than under any of the other alternatives due to the greater amount land available for leasing, likely resulting in an increased need for pads, pipelines, roads, and associated infrastructure. The magnitude of potential impacts to bird populations as a result of collisions in areas of oil and gas development will depend, among other variables, on the location and type of the structure, the species involved, the lighting regime employed, and the weather conditions. All of the special status species would likely be impacted at the level of the individual and not at a population level.

Disturbance. The potential for disturbance to special status species from ground-based travel on roads, within pads, and cross-tundra would likely be greater under Alternative D than under Alternative A. After the expiration of the 2014 and 2018 deferrals Alternative D would provide about 43 percent more lands available for oil and gas leasing (including a large tract of important bird habitat east of Dease Inlet and around Teshekpuk Lake), resulting in an increased need for pads, pipelines, roads, and associated infrastructure. This area around Teshekpuk Lake supports high densities of spectacled eiders. Potential impacts from summer cross-country travel on tundra would be limited in Alternative D, the same as all other alternatives, and would only be allowed on a case-by-case basis, and only after extensive studies have been conducted (Required Operating Procedure/Best Management Practice L-1).

Aircraft, both fixed-wing and helicopter, would provide access for oil and gas-related activities throughout the development, operation and abandonment of any oil or gas field developed in the NPR-A. The types of disturbance effects to special status species from aircraft would be the same under Alternative D as those discussed under Alternative A, and could include displacement from preferred feeding habitats, temporary or permanent nest abandonment, and temporary or permanent displacement from staging, molting or brood-rearing areas. Aircraft disturbance effects would be greatest in Alternative D as compared to all other alternatives.

The types of disturbance effects to special status species from watercraft would be the same under Alternative D as those discussed under Alternative A, and could include displacement from preferred habitats and nest abandonment. As the expected number of sealifts in Alternative D would be higher than in Alternative A, the impacts from special status species collisions with barges would also be higher in Alternative D.

Oil spill response training activities using watercraft could be conducted on rivers and lakes several times during the summer. The potential for disturbance to special status species from these activities would likely be greater under Alternative D than under Alternative A due to the greater amount land available for leasing, likely resulting in an increased need for pads, pipelines, roads, and associated infrastructure. The extent of effects to special status species from oil spill and gas release response activities would depend on the species and numbers of individuals occurring in areas within and adjacent to the impacted area.

Predation. Some predators, such as ravens, gulls, arctic foxes, and bears could be attracted to areas of human activity where anthropogenic sources of food and denning or nesting sites were present. The potential impacts of increased numbers of predators on eiders are discussed under Alternative A. Increased predation pressure could have moderate impacts on any of the special status species. Under Alternative D, the types of effects to special status species populations would be the same as those discussed under Alternative A. Under Alternative D, there would be greater potential for special status species mortality due to predation than under any of the other alternatives, as there would be more human activity and anthropogenic sources of food available.

Abandonment and Reclamation

Development scenarios indicate that at abandonment of the field, gravel pads and roads may or may not be removed, and that reclaimed or abandoned pads may be revegetated by native vegetation or would be allowed to bed naturally. Given that scenario, it is very difficult to determine potential effects to special status species from these unknown activities. For this document, it is assumed that all gravel will be removed after abandonment. Given that assumption, the impacts of abandonment and reclamation of oil and gas fields on special status species would be similar in many respects to those incurred by construction activity. The types of impacts would be the same for Alternative D as described in Alternative A. Impacts would likely be greater for Alternative D than for any of the other alternatives, as more area would be available for oil and gas development in Alternative D, resulting in a greater total area to be abandoned and subsequently reclaimed.

Oil Spills and Gas Releases

Under Alternative D, the types of and effects to birds from oil and seawater spills and gas releases would be the same as those discussed under Alternative A.

Although the estimated large spill volume is the same for all alternatives, the probability of a spill occurring varies little between Alternatives A, C, and D (37, 37, and 39 percent, respectively) while Alternatives B-1 and B-2 are estimated to have a 28 and 30 percent chance of a large spill, respectively. Even with the protection of particularly sensitive areas (e.g., coastal shoreline), and the substantial emphasis on spill prevention and response, if a large crude oil spill occurred it could have a measurable effect on some special status species at a population level. Exceptions to this would be the species whose range only peripherally includes the NPR-A or adjacent marine waters, such as golden eagle, red knot, and Kittlitz's murrelets, or those not associated with water (e.g., golden eagle and short-eared owl). Effects to individual birds that make contact with oil or oiled forage could range from short-term disturbance to death. This applies to all of the special status species regardless of how uncommon they are; in fact, this is one of the few ways that red knot, Kittlitz's murrelet, or golden eagle could potentially be impacted by any alternative. Impacts to special status species (especially yellow-billed loon and eiders) on a population level could occur if oil from a large spill entered rivers, important molting or brood-rearing lakes, or marine areas during periods when large proportions of those species are present. Many factors would determine the probability and extent to which birds would be negatively impacted by a large oil spill, including the quantity spilled, season, location (e.g., land versus water), and proximity to sensitive habitat. Although the probability of a spill varies by alternative the impacts to individual birds from large crude/refined oil spills would be the same as under all alternatives if a spill was to occur in a location where birds were present.

The potential for disturbance to birds from an oil spill would likely be greatest under Alternative D, as compared to all other alternatives, due to the diminishment of protections existing in the areas that contain large numbers of special status species, and a greater estimated number of oil development pads, pipelines and associated infrastructure that would be constructed.

Oil entering a river or stream could potentially spread into delta or coastal areas, where impacts could be more severe to staging or molting yellow-billed loons, spectacled or Steller's eiders. An oil spill in coastal zone and nearshore habitats of the Colville River Delta, Harrison Bay, Smith Bay, Dease Inlet, Elson Lagoon, or Kasegaluk Lagoon, which support large congregations of threatened eider species, could affect large numbers of individual birds. Under all alternatives, the potential that an oil spill would enter a major river or stream would be minimized by Stipulation K-1. This would provide setbacks from specified rivers, within which permanent oil and gas facilities would be prohibited, although pipelines may be allowed in some of these areas. The greater need for marine transportation under Alternative D relative to Alternative A would increase the opportunity for a spill to occur. For further discussion of potential effects of marine spills, see Alternative A.

A gas release from a well is expected to last one day and to release 10 thousand cubic feet of gas while a release from a transmission pipeline or processing facility is estimated to release 20 thousand cubic feet over a few hours. Although the estimated release volume is the same for all alternatives, the difference in the estimated number of gas production wells and lengths of various pipelines would change the probability of a release between the alternatives. The potential for disturbance to birds from a gas release would likely be greater under Alternative D, due to the greater amount land available for leasing, likely resulting in an increased need for pads, pipelines, roads, and associated infrastructure, and the protections imposed on some areas that may contain large numbers of special status species.

Effectiveness of Stipulations and Best Management Practices

Alternative D makes 100 percent of the NPR-A available for oil and gas leasing while retaining the four existing Special Areas and providing numerous surface protections. The current surface deferrals would be honored until expiration.

All alternatives, including Alternative D, contain numerous stipulations and best management practices that would effectively protect special status species and their habitats in the NPR-A (see Alternative A for a full listing). These include Best Management Practices A-1 and A-2, which address the proper storage, handling, and disposal of solid, liquid, and hazardous wastes (including fuels), as well as Best Management Practices A-3 through A-7, which address hazardous material releases and oil spills through prevention, storage, handling, and disposal. The protection of special status birds, their habitats, and food sources are addressed by Best Management Practices B-1, B-2, C-2, C-3, C-4, D-2, E-9, E-12, and Stipulations E-2 and L-1, among others. Protection J would help minimize the take of species listed under the Endangered Species Act, as would Best Management Practices E-11 and E-18, which contain specific language aimed at reducing impacts to spectacled and Steller's eiders, including their nests and brood-rearing areas. The "B" best management practices would help limit the impact of water withdrawals on lakes, or lake habitats, used by eiders, while the "C" best management practices govern seismic ground operations to prevent seismic activity-related disturbance to eiders and provide protection for over wintering invertebrates, which are sources of food for eiders. In addition, there are numerous best management practices and stipulations that would protect some special status species and their habitats by regulating the types of activities that can occur near waterbodies, including rivers and streams, types of equipment that can be used, and types of exploration and development activities that can be conducted in the planning area.

Alternative D provides stipulations and best management practices that provide protection to surface resources that are less restrictive than in other alternatives and several stipulations common to all other alternatives to protect biological resources near Teshekpuk Lake would not apply in Alternative D. As there has been no oil or gas development yet in the NPR-A, it is difficult to determine the effectiveness of the above-mentioned best management practices and stipulations. Required operating procedures and stipulations that have been in effect in the NPR-A to date regulate exploratory activities, and thus far, seem to be effective in protecting birds and bird habitats.

Conclusion

Under Alternative D, 100 percent of the NPR-A's approximately 22.8 million subsurface acres could be offered in future oil and gas lease sales, though approximately 2 million acres of the available lands would remain deferred from leasing until 2014 or 2018. This alternative retains 8.3 million acres within four Special Areas. Alternative D would allow more infrastructure into areas of very high value to some special status species than any other alternative, and in this aspect, would be less protective than the other alternatives and may result in increased habitat loss, disturbance, or mortality. A corridor for infrastructure associated with offshore development in the Chukchi Sea could be accommodated.

Non-oil and gas activities that could potentially affect special status species would be the same as those in Alternative A. Under all alternatives, this analysis shows that impacts to special status species from non-oil and gas activities would be minor.

The overall level of development likely to occur under Alternative D is greater than that under any other alternative. The potential for habitat loss and alteration to affect special status species would be greater under Alternative D, as compared to Alternative A, as the amount of high-use spectacled eider habitat that would be lost to gravel infrastructure would be greater, and there would be a higher potential for infrastructure to be located in areas of high spectacled eider use in the Teshekpuk Lake Special Area. Stipulations and best management practices established for Alternative D would help to mitigate potential impacts to special status species.

Under Alternative D, the types of disturbances related to vehicle, aircraft, pedestrian, and vessel traffic, routine maintenance activities, heavy equipment use, facility noise, and oil spill and gas release cleanup activities would be similar to those described under Alternative A. Under Alternative D, types of impacts to special status species would be similar to those discussed under Alternative A, but would be greater in frequency and extent because of the high oil and gas potential of the northern portion of the NPR-A, and the future potential for greater development to occur, including in areas currently off-limits to surface-development activities. It is expected that impacts to special status species in the vicinity of Teshekpuk Lake, and throughout the northern portion of the NPR-A, would be greater under Alternative D, particularly with respect to spectacled eiders and yellow-billed loons, as none of the high-use special status species habitat in the NPR-A is unavailable for leasing in this alternative after the deferral expires in 2018.

The potential for special status species mortality resulting from collisions with vehicles (air or ground) or infrastructure and marine vessel traffic would be greater under Alternative D, because the amount of infrastructure and barge traffic would be greater than under the other alternatives. The potential for an oil spill to impact special status species would also be greater under Alternative D, as compared the other alternatives, given the estimated greater amount of infrastructure and development activity in this alternative.

Stipulations and best management practices established under Alternative D would help to mitigate potential impacts to special status species. Effectiveness of stipulations and best management practices is unknown at this time, but they are presumed to be effective.

In general, impacts to special status species from non-oil and gas activities, and from oil and gas exploration and development activities, would be additive. Potential impacts from seismic activity would vary by alternative with Alternative A expecting to require five exploratory and six developmental seismic surveys (see Table 4-11 in Volume 2). Alternative D is estimated to require 16 total seismic surveys, which will cover a greater area than would be needed under any other alternative. The expected number of oil and gas fields and the level of development under Alternative D would be greater than under any other alternative. Therefore, it is expected that the potential effects of disturbance, habitat loss and alteration, and mortality due to oil and gas exploration and development under Alternative D would be greater than under any other alternative. All alternatives would minimize unintentional take of migratory birds and conserve migratory bird populations. The special status species susceptible to the greatest amount and types of impacts include those that regularly breed on NPR-A's tundra, where most activities would occur (i.e., Steller's eider, spectacled eider, yellow-billed loon, and short-eared owl). The remaining species (golden eagle, red knot, and Kittlitz's murrelet) would be infrequently exposed to activities, and would be susceptible primarily just to collisions and oil spills. In the absence of a large oil spill, none of the special status species would be expected to incur population-level effects from full implementation of Alternative D.

Although many of the forces driving global climate regime shifts may originate outside the Arctic, the impacts of global climate change are exacerbated in the Arctic (Arctic Climate Impact Assessment 2004). Temperatures in the Arctic have risen faster than in other areas of the world, as evidenced by glacial retreat and melting sea ice. Special status species whose range in Alaska is concentrated in the Arctic may be the most vulnerable to the effects of a changing climate. These species include: yellow-billed loon, spectacled and Steller's eider, and red knot. Effects to these special status species from climate warming may include a suite of effects, both positive and negative. A longer open-water season may increase productivity of some species of shorebirds and increase productivity in aquatic and semi-aquatic systems that provide food for yellow-billed loon, spectacled and Steller's eider. Warmer soil temperatures are likely to increase thermokarst, and increases in sea level may inundate low-lying tundra areas, increasing salt marsh, aquatic and wet tundra vegetation types, and erosion of coastal bluffs (Arctic Climate Impact Assessment 2004) causing changes in coastal habitats that may quickly result in changes in vegetation that influence habitat suitability and availability for spectacled and Steller's eiders (Mars and Houseknecht 2007). The increasing thickness of the active layer of soil above arctic permafrost is likely to cause changes in moisture regimes and the distribution of vegetation types over much of the Arctic in coming years. Drying of wetlands would result in negative effects to spectacled and Steller's eiders that rely on shallow water and wet meadows, and shrub expansion may reduce the quality and availability of some types of habitats. Such impacts could accelerate or exacerbate changes in soil thermal regimes that occur with development, potentially leading to greater impacts to special status species habitat. Increase in human economic activities such as shipping and offshore oil and gas development may influence the abundance and distribution of predators, which may negatively affect special status species populations. These changes may be beneficial to some special status species such as those associated with boreal forest or shrub habitats (golden eagle), but a reduction in the amount of tundra habitat available could negatively impact spectacled and Steller's eiders, red knot, and short-eared owl, and add to the cumulative effects of oil and gas development. High rates of coastal erosion and storm surges have led to saltwater intrusion into freshwater habitats, and such intrusions may alter foraging and brood-rearing habitats for spectacled and Steller's eiders.

4.7.11.3 Special Status Species of Terrestrial Mammals

Two species of terrestrial mammals listed as BLM Sensitive Species are described in section 3.3.8 in Volume 1. Neither of these has been found within the NPR-A in recent decades. The Alaskan hare has not been reported on the North Slope since 1951, and the Alaska tiny shrew has never been documented in the NPR-A. The types of impacts to these two mammalian species would be the same as those for all other terrestrial mammals. These impacts are described in section 4.7.9, and are repeated here only briefly.

Under Alternative D, development would be unlikely to affect either of these two species, primarily because it is unlikely that either exists in the NPR-A. This is especially so for the Alaskan hare, since if this relatively large-bodied species occurred in the NPR-A, it would most likely have been documented one or more times in the last 60 years. It is more likely that the Alaska tiny shrew has occurred or does occur in the NPR-A without having been documented. If development facilities were constructed in an area containing a population of Alaska tiny shrew, adverse impacts to that population could occur. These impacts would most likely be manifested in the loss of habitat, and could also involve the deaths of some individuals if they were to be run over by heavy equipment during construction of development facilities.

4.7.11.4 Special Status Species of Marine Mammals

Activities Not Associated with Oil and Gas Development and Exploration

Baleen Whales

Effects of activities not associated with oil and gas exploration and development on bowhead, fin, and humpback whales would be similar to the other alternatives.

Ice Seals

Aircraft and vessel traffic are the non-oil and gas activities most likely to have a direct impact on ringed and bearded seals. The potential effects of these activities are described under Alternative A. Impacts from activities not associated with oil and gas exploration and development would not differ from those described under the other alternatives and would be negligible.

Polar Bear

Winter overland travel is the non-oil and gas activity likely to have the most effect on polar bears in the NPR-A. Potential impacts to polar bears from this and other activities are described in Alternative A. No difference in the potential to impact polar bears, nor in the level of impact, would be expected between Alternatives A and D.

Pacific Walrus

Potential impacts from non-oil and gas activities would be similar to those discussed under Alternative A. No difference in the potential to impact walrus, nor in the level of impact, would be expected between Alternatives A and D.

Oil and Gas Exploration and Development Activities

Baleen Whales

The types of effects to bowhead, fin, and humpback whales from oil and gas exploration under Alternative D would be similar type to the other alternatives, although the likelihood and magnitude of potential effects may be greater. With maximum acreage available for leasing and only one marine Special Area (Kasegaluk Lagoon Special Area), there could be more barge activity, more aircraft flights, and more noise imparted to the marine environment under Alternative D.

Seismic Activities. Effects from onshore seismic surveys would be similar to the other alternatives and expected to have behavioral effects to only a small number of cetaceans since most surveys would take place onshore or during periods when whales are absent. Seismic surveys in nearshore lagoons and bays during the open water season could result in disturbance effects on bowhead whales as described under Alternative A in section 4.3.11.4 in Volume 2. Fin and humpback whales only infrequently occur in the Chukchi Sea and are rarely, if ever, seen in the Beaufort, so are unlikely to be impacted. Although some individual bowhead whales may be temporarily disturbed by coastal seismic activities, population-level impacts are unlikely.

Shipping. Effects from shipping under Alternative D may be proportionately greater than the other alternatives because of the increased acreage available for leasing and presumably more oil and gas activity in the NPR-A. The one marine Special Area (Kasegaluk Lagoon Special Area) could result in fewer nearshore barge transits in that location and less noise imparted into adjacent marine waters. However, it seems likely the Cape Simpson, Lonely and Point Franklin areas where bowhead whales are known to feed would be used as staging areas, and that effects from shipping would occur. Ship/whale collisions are expected to be relatively rare, but are most likely to take place under Alternative D relative to the other alternatives.

Ice Seals

Potential types of direct and indirect effects on ringed and bearded seals from activities authorized under Alternative D do not differ from those described under Alternative A. Oil and gas-related effects, however, would likely be more pronounced than those disclosed under Alternative A and all other alternatives. Alternative D would open all coastal areas for leasing after deferrals expire (Map 2-4). This increases the possibility of production oil spills directly into several important marine waters, and may expose seals to other direct impacts, as well (however, the lair survey and avoidance requirement of Best Management Practice C-1 would apply the same as in Alternatives B-1, B-2, and C). The chance for an onshore spill to reach marine waters may be more effectively minimized under this alternative relative to Alternative A due to the inclusion of twice as many rivers with setbacks in the K-1 Stipulation, and more coastal areas included in development restrictions of Stipulation K-6. Both species would still be sensitive to refined oil spills and discharge related to shipping traffic in support of onshore activities the same as Alternative A. Stipulations K-3b and K-8, present in some form for all other alternatives, do not exist in Alternative D. Absence of K-3b may create enhanced effects from less restricted exploration and development activities. Seals in Kasegaluk Lagoon would not receive protections through Stipulation K-8 or special area designation. Seals may also be affected by aircraft flights and marine traffic near terrestrial haulouts the same as in Alternative A.

Polar Bear

Seismic Activities. A higher level of overall disturbance to polar bears from seismic surveys would be expected under Alternative D than is described for Alternative A or expected under any of the other alternatives. Seismic surveys conducted within approximately 5 miles of the coast could expose undetected polar bear dens to noise and associated disturbances, resulting in the displacement of maternal polar bears and their dependent cubs, abandonment of the den, and possible death of cubs. Best Management Practice C-1 prohibits cross-country use of heavy equipment and seismic activities within 1 mile of known polar bear dens and requires operators to consult with the U.S.

Fish and Wildlife Service before initiating activities in coastal habitat between October 30 and April 15. Depending on the suitability of the area for polar bear dens, the operator may also be required to survey for dens prior to seismic activities. This combination of procedures minimizes the chance that denning polar bears would be disturbed by seismic activities. Impacts to individual female polar bears and cubs would only occur in the unlikely instance that a den would go undetected during a survey. No population-level impacts are anticipated.

Exploration. It is estimated there could be up to 60 oil exploration and delineation wells and 196 gas exploration and delineation wells drilled under Alternative D. These wells are expected to be drilled from ice pads, causing short-term ground disturbance of 360 and 1,176 acres, respectively. The actual number of exploratory wells with potential to affect polar bears is not currently known; but only those wells drilled within 25 miles of the coast should have the potential to directly affect polar bears, and only those within 5 miles of the coast have the potential to affect denning polar bears.

Exploratory drilling near the coast during winter (December to mid-April) could potentially disturb, displace, or attract polar bears. As described under Alternative A, the primary threat to polar bears would be disturbance to females in maternal dens and attraction of non-denning bears to support facilities.

Conservation measures have been established to protect female polar bears denning within one mile of construction activity. Best Management Practice C-1 requires all industrial activities maintain a 1-mile buffer around known or suspected polar bear dens. In addition, oil and gas exploration activities within polar bear habitat require coordination by the operator with the U.S. Fish and Wildlife Service to locate any potential polar bear dens prior to winter exploration activities.

Lease stipulations and Best Management Practices A-1 and A-2, which require proper waste prevention, handling, and disposal, would be effective in preventing or minimizing attraction of polar bears. Best Management Practice A-8, requiring implementation of a bear-interaction plan, would reduce the likelihood of negative human-bear encounters. These plans include measures to minimize attraction of bears to industrial facilities, methods for communicating to workers about bears in the area, and an outline of proper procedures to follow in the event that bears are observed near industrial facilities and work sites. Lessees would be required to keep a systematic record of bears onsite and in the immediate area, which could be used to inform future stipulations and policies intended to minimize human-bear conflicts. Such requirements for facility management and human-bear interaction plans have been successfully implemented at oil and gas exploration and production facilities in other portions of the North Slope. It is anticipated that impacts to polar bears attracted to exploration activities in the planning area would also be minimized and actively managed to promote human safety, while limiting detrimental effects to the bears.

Development and Production. Under Alternative D, more coastal areas would be immediately open for oil and gas leasing than under Alternative A. Surface disturbances would include gravel production pads and central processing facilities for oil and gas, gravel roads, gravel runways, and several types of pipelines (some of which may be buried). Under Alternative D, the long-term disturbance footprint would be

16,329 acres. The actual number of development and production facilities (and associated gravel footprint) with potential to affect polar bears is unknown at present. Only facilities within 25 miles of the coast are likely to directly affect polar bears, and facilities within 5 miles of the coast could affect maternal dens.

Impacts to polar bears, including disturbance, caused by development and production activities would likely be greater than those described for Alternative A, since all lands would be available for oil and gas leasing, with the exception of the current deferrals that expire in 2014 and 2018.

The same avoidance and mitigation measures would be utilized during construction operations that take place during the exploration and development and production stages, including avoiding denning polar bears by one mile and implementing human-bear interaction plans and training for facility personnel. Additionally, Best Management Practice E-5 would require that facilities be designed to minimize impacts of the development footprint, while Best Management Practice E-4 would require sound pipeline construction to minimize leaks; these practices would help minimize take of listed species.

Oil Spills and Gas Releases. Alternative D, like Alternative A, poses some risk of small and large spills of oil, refined fuel, and produced water and potential for gas releases. These events could happen at any time of the year. Polar bears could come into contact with unrecovered oil on land, on ice, or at sea. The results to the physical health of the bear would be the same regardless of location.

The impacts of oil spills and gas releases on polar bears are described in detail under Alternative A. Direct oiling could lead to hypothermia and result in increased energy costs or death. Oiled polar bears would ingest oil by grooming, and polar bears could also ingest oil by eating oiled prey or carcasses. Ingested crude oil is highly toxic to polar bears (Oritsland et al. 1981; Stirling 1990). Exposure to oil or associated fumes could cause respiratory distress and inflammation of mucous membranes and eyes, leading to abrasions and ulcerations. Even partial oiling of a polar bear is likely to result in mortality, while chronic low levels of exposure could result in sublethal effects that reduce fitness.

Compared to Alternative A, the risk of oil spills under Alternative D would be slightly more. The number of small spills of both crude and refined oil is assumed to be 5 percent more than that assumed for Alternative A. Although the likelihood of an individual bear coming into contact with a small spill is still very low, polar bears could avoid coastal areas that were fouled by oil or be displaced by response activities, which could result in impacts to fitness, breeding success, or survival. Alternative D slightly elevates the risk of these impacts from small spills. Effects of a small spill would be short-term (days to weeks), localized, and at most should affect very low numbers of individuals.

The risk of large spills for each alternative is based on the volume of oil expected to be produced over the life of the oil exploration and development that might proceed from leasing and discoveries in the NPR-A. For Alternative D, the percent chance of one large spill occurring is 39 percent. The risk of a large spill is higher under Alternative D than under any other alternative, although this risk is only slightly higher than under

Alternatives A and C. The potential impacts to polar bears resulting from a large oil spill are discussed in Alternative A. Under any of the alternatives, the extent of impacts from a large oil spill would depend on the size, location, and timing of spills relative to polar bear distributions and on the effectiveness of spill response and cleanup. A population-level effect may be expected if a spill were to contact an aggregation of bears. Polar bears are generally widely dispersed in the planning area; and, in the event of a large oil spill, it is most likely that only a small number of polar bears would be directly affected through oiling. However, even a few individuals removed from the threatened populations of polar bears could be significant to the recovery of the local population, particularly if females or females with cubs were oiled. Response activities associated with a large spill also have the potential to disturb or affect polar bears; displace them from feeding, resting and denning areas; and potentially contaminate the food chain.

As under Alternative A, there is a small risk that a large gas release could occur from a platform, pipeline, or onshore facility. Direct impacts to polar bears would be minimal because gas would quickly dissipate. Although a bear in the immediate vicinity could potentially experience impacts from inhaling gas, or be injured or killed if an explosion occurred with the release, these scenarios are unlikely. Impacts to polar bears may occur as a result of response activities. If disturbance caused polar bears to be excluded from feeding, resting, or denning areas, this could impact body condition, breeding success, or survival.

Effects of Abandonment and Reclamation. Effects of abandonment and reclamation would generally be similar to those under construction during the exploration and development and production stages. Human activities, particularly visual and noise components, could disturb individual polar bears, including both denning and non-denning bears. Disturbing known denning polar bears would be avoided as during construction activities. No population-level effect would be expected.

Pacific Walrus

The oil and gas activities that could affect walrus in Alternative D would be similar to those described under Alternative A. Under Alternative D, impacts to walrus from oil and gas activities would be unlikely because Lease Stipulation K-6 may restrict permanent oil and gas facilities (including gravel pads, roads, airstrips, and pipelines) within the coastal area, which includes all barrier and offshore islands within the NPR-A and a coastal strip extending three-quarters of a mile inland from the coast. These protections would benefit walrus by restricting oil and gas development in the vicinities of several known walrus haulouts areas on the NPR-A Chukchi Sea coast.

Effectiveness of Stipulations and Best Management Practices

Baleen Whales

The effectiveness of stipulations and best management practices would be similar to that of the stipulations and required operating procedures in Alternative A, although may offer less protection because Stipulation K-3b would not apply.

Ice Seals

The stipulations and best management practices of Alternative D, as they relate to ice seals, are similar to the required operating procedures and stipulations in Alternative A. Notable exceptions are Stipulations K1 and Best Management Practice C-1. In Alternative D, Stipulation K1 would more effectively minimize the chance that an onshore oil spill would reach marine waters by including twice as many rivers as what are named in Alternative A (i.e., Alternative D uses the same list as Alternatives B-1, B-2, and C). Best Management Practice C-1 is made more effective in this alternative than in Alternative A, due to the explicit requirement for operators to conduct a survey to detect (and then avoid) seal birthing lairs for activities during the seal pupping season (through April 15). As with all other alternatives, discharge from support vessels may not be effectively regulated through the A-series required operating procedures, and could result in impacts to both species. As with the other alternatives, overflight restrictions in Best Management Practice F-1 are not specifically managed to avoid marine mammals; however, Alternative D completely lacks Stipulations K-3b, which conferred some potential to reduce aviation impacts in all of the other alternatives.

Polar Bear

Many of the lease stipulations and required operating procedures in Alternative D would provide effective protection to polar bears and their habitats within the planning area. Best Management Practices A-1 through A-8 would ensure that solid, liquid, and hazardous waste do not attract polar bears or degrade their habitat. They would also require a public safety plan that includes bear-interaction plans to avoid or minimize many potential human-bear conflicts. Best Management Practice C-1 would prohibit seismic activities and the use of heavy equipment within 1 mile of known polar bear dens and require lessees to comply with requirements under the Marine Mammal Protection Act. Best Management Practice E-5 would require that facilities be designed to minimize impacts of the development footprint, while Best Management Practice E-4 would require sound pipeline construction to minimize leaks; these practices would help minimize take of listed species. Best Management Practice I-1 would require orientation programs for oil and gas personnel, informing them of the importance of not disturbing biological resources, including endangered species and marine mammals. Protective measure J indicates BLM would not approve any activity that may affect a listed species, until it completes its obligations under applicable requirements of the Endangered Species Act. Best Management Practices/Lease Stipulations K-1, K-4, K-6, and K-11 would confer some benefits to polar bears. These stipulations would: (1) limit activities along the banks of rivers and some lakes, reducing sources of disturbance in potential denning habitat; (2) limit activities in coastal habitats, reducing the potential for sources of disturbance and obstructions in this polar bear movement corridor; and (3) require year-round spill response capability during periods of broken ice or open water in certain inlets, bays, lagoons, and barrier islands important to polar bears.

Pacific Walrus

Best Management Practice I-1 would require lessees to implement a program to inform personnel about the importance of not disturbing biological resources, including marine mammals. This required operating procedure should minimize direct disturbance to walrus from human activities.

Lease Stipulation K-6 for coastal areas was developed to protect summer shoreline habitat for polar bears, walrus, and seals. It may restrict establishment of permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines to support exploration and development activities within the Coastal Area, which includes all barrier and offshore islands within the NPR-A and a coastal strip extending three-quarters of a mile inland from the coast. The exception would be for valid existing oil and gas leases. In a case where the BLM authorized a permanent facility within the Coastal Area, the lessee/permittee would be required to develop and implement a monitoring plan to assess the effects of the facility and its use on coastal habitat and use.

Conclusion

Baleen Whales

Under Alternative D, most impacts will be associated with marine shipping and barging. Most of the associated impacts to large whales are related to marine noise, but ship/whale collisions are a possibility particularly under Alternative D. Impacts may be slightly higher under Alternative D compared with the other alternatives, because of the larger amount of acreage available for leasing. Even with increased activity, population-level effects to bowhead, fin, and humpback whales are unlikely.

Ice Seals

Alternative D provides the least protection to ringed and bearded seals compared to the other alternatives, and both species could be negatively impacted by development activities. The most likely impact to ringed and bearded seals under Alternative D from non-oil and gas-related activities would be haulout disturbance by aircraft and would likely be negligible. Impacts to ringed and bearded seals from oil and gas activities could include disturbance from aircraft, the potential for a large contaminant spill, and for ringed seals, disturbance to pupping lairs. Ringed seal pups would be adequately protected if lairs are surveyed and avoided as directed by Best Management Practice C-1. Alternative D, does not prohibit leasing in any area or designate Special Areas and as such provides inadequate protection from the before mentioned effects. Bearded and ringed seals within and adjacent to the NPR-A planning area may be negatively impacted under Alternative D and the highest chance for impacts to a large number of animals of both species exists under this alternative.

Climate change effects, when coupled with development, could have increased adverse effects for these species. The added stresses of diminished sea-ice habitat due to climate change may leave ice-dependent species, such as ringed and bearded seals, more vulnerable to effects of oil and gas activities. How either species will respond to changes in sea ice and snow conditions is currently debatable. Ringed seals have the greatest potential for negative effects through the loss of ice substrate for hauling out during critical energetic periods and lower quality pupping areas. Bearded seals are most likely to be impacted by reduced access to prey resources near ice-associated haulout areas and by limited haulout substrate during energetically important periods. The mechanisms by which effects of climate change and anthropogenic activities interact are unknown, but could range from synergistic to countervailing. Alternative D provides the least protection for spotted and ribbon seals, and may have greater adverse effects on these species, particularly spotted seals. Therefore, the combined effects of climate change and development activities could increase under Alternative D compared to the other proposed alternatives.

Polar Bear

Under Alternative D, all of the NPR-A's approximately 22.8 million subsurface acres could be offered in future oil and gas lease sales. Many of the currently protected coastal areas important to polar bears would be available for exploration and development when the existing deferrals expire. It is expected that under Alternative D, the potential effects of disturbance, habitat loss and alteration, and potential mortality due to development would be higher than under the other alternatives.

Non-oil and gas activities would be highly localized (e.g., worksites or camps) and/or transient (e.g., surveys and inventories). While non-oil and gas activities may result in disturbance to individual polar bears and may prevent some polar bears from using small portions of habitat temporarily, the activities are not anticipated to have long-term impacts to individual polar bears or measurable impacts at the population level. Consultations with the U.S. Fish and Wildlife Service under the Endangered Species Act will address potential impacts associated with permitted non-oil and gas activities. Oil and gas activities may likewise result in disturbance to individual polar bears and may prevent some polar bears from using small portions of their habitat temporarily. Endangered species consultations will address those oil and gas activities that could affect polar bears and their critical habitat. Population-level impacts are, therefore, not expected as a result of oil and gas activities, with the exception of a large oil spill. Under some scenarios, a large oil spill could result in population-level effects or long-term impacts to the food chain. The likelihood of such an event is higher under Alternative D than under Alternatives B-1 and B-2, but is nearly the same as under Alternatives A and C.

Pacific Walrus

Alternative D would make all lands available for leasing, except for certain lands that are currently deferred from oil and gas leasing (for the length of the current deferrals). There would be a 97,000-acre Kasegaluk Lagoon Special Area and a coastal area with minimized activity, as described in Stipulation K-6 and discussed in Alternatives B-1 and C for this analysis. However, Alternative D does not provide for the establishment of a Peard Bay Special Area, a portion of the Chukchi coastline that contains important nearshore waters for marine mammals and walrus haulouts. Under Alternative D, the effects of most non-oil and gas activities on walrus would largely be avoided, although adverse impacts could be experienced due to aircraft and vessel activity too close to haulouts. Overall, Alternative D is less protective of walrus than Alternatives B-1, B-2, or C because it does not include a Peard Bay Special Area. Peard Bay has increasing importance as an area of value for walrus hauling out on the Chukchi coastline, an emerging phenomena as walrus increasingly must rest on shore when summer sea ice is unavailable.

4.7.11.5 Potential New Mitigation Measures

Potential Mitigation Measure 1—Surveys for Sensitive Plant Species (new best management practice)

The objective and requirement/standard would be the same as those described in section 4.3.11.5 for Potential Mitigation Measure 1—Surveys for Sensitive Plant Species. The potential benefits and residual/unavoidable impacts would be similar to those described for Alternative A at section 4.3.11.5.

Potential Mitigation Measure 2—Surveys for Sensitive Terrestrial Mammals (new best management practice)

The objective and requirement/standard would be the same as those described in section 4.3.11.5 for Potential Mitigation Measure 2—Surveys for Sensitive Mammals. The potential benefits and residual/unavoidable impacts would be similar to those described for Alternative A at section 4.3.11.5.

Potential Mitigation Measure 3—Aircraft Avoidance of Walrus Aggregations (addition to Best Management Practice F-1)

The objective and requirement/standard would be the same as those described in section 4.3.11.5 for Potential Mitigation Measure 3— Aircraft Avoidance of Walrus Aggregations. The potential benefits and residual/unavoidable impacts would be similar to those described for Alternative A at section 4.3.11.5.

Potential Mitigation Measure 4—Marine Vessels Avoidance of Walrus Aggregations (K-6 Stipulation- Coastal Area)

The objective and requirement/standard would be the same as those described in section 4.3.11.5 for Potential Mitigation Measure 4—Marine Vessels Avoidance of Walrus Aggregations. The potential benefits and residual/unavoidable impacts would be similar to those described for Alternative A at section 4.3.11.5.

Potential Mitigation Measure 5—Vessel Operation (Addition to H-1 Required Operating Procedure)

The objective and requirement/standard would be the same as those described in section 4.3.11.5 for Potential Mitigation Measure 5—Vessel Operation. The potential benefits and residual/unavoidable impacts would be similar to those described for Alternative A at section 4.3.11.5.

4.7.12 Cultural Resources

4.7.12.1 Activities Not Associated with Oil and Gas Exploration and Development

Under Alternative D, the types of non-oil and gas activities would be the same as those described for Alternative A (see section 4.3.2.1 in Volume 2), and the potential impacts to cultural resources would be the same.

4.7.12.2 Oil and Gas Exploration and Development Activities

Effects of Seismic Surveys

Under Alternative D, the level of seismic activity is anticipated to increase moderately over that of Alternative A (see section 4.3.2.2 in Volume 2). Compared to Alternative A, the increase could be as much as 25,310 survey or camp train miles, about 45 percent, and 248,551 surveying or camp train acres, about 46 percent. However, given the historically low impact from seismic activity, this is not regarded as a meaningful increase in terms of potential impact to cultural resources. Therefore, the probability of encountering and impacting scientifically significant cultural material under Alternative D remains low.

Effects of Short-term Disturbance: Exploration and Delineation Drilling

Short-term impact-producing activities include drill pads, roads, and airstrips constructed of ice and snow. Under Alternative D, it is anticipated that gas well drilling and delineation activities would increase significantly, causing concomitant increases in the construction of associated ice and snow infrastructure. Overall, this activity would increase to more than 459,500 acres; nearly a 41 percent increase compared to Alternative A (see section 4.3.2.2 in Volume 2). Despite the increase in acreage, the potential for impacts to cultural resources remains low, as modern exploration and delineation activities historically have had little impact on the resource.

Effects of Long-term Disturbance: Development of Oil and Gas Infrastructure

Under Alternative D, the amount of potential disturbance to cultural resources from construction of central processing facilities and associated satellite pads, roads, airstrips, pump or compressor stations, and gravel pits in regard to surface area is increased by more than 6,400 acres, nearly 65 percent. There would also be about 55 million cubic yards of gravel mined, an increase of about 15 million cubic yards or about 37 percent, compared to that of Alternative A. Also by comparison, the number of potential vertical support members is the same, while gas pipeline trenching could increase by 1,385 miles, nearly doubling the amount of surface disturbance and potentially adding slightly more than 5.3 million cubic yards to the total of excavated material. While the area of potential impact has increased, because pre-work cultural resource surveys are required, the level of potential impact remains the same, relatively low.

Effects of Oil Spills and Gas Releases

Under Alternative D, the effects of spills on cultural resources would be essentially the same as discussed under Alternative A (see section 4.3.2.2 in Volume 2). As previously addressed in section 4.3.12.2 in Volume 2, although the area of potential impact has increased, the level of potential impact remains low. As previously described in section 4.3.12.2 of Volume 2, there would probably be no adverse effect on cultural resources from a gas release.

Effects of Abandonment and Reclamation

As previously described in section 4.3.2.2 of Volume 2, abandonment and reclamation of short-term and long-term infrastructure would under most circumstances, have limited, if any, impact on cultural resources.

4.7.12.3 Effectiveness of Stipulations and Best Management Practice

Under Alternative D, the primary safeguard for cultural resources is Best Management Practice E-13, which states that lessees will conduct a cultural resources survey prior to engaging in any potential ground-disturbing activity. There are other regulations, laws, and procedures, which also provide protections for cultural resources (see section 4.3.2.3 in Volume 2).

4.7.12.4 Conclusion

The primary potential impact to cultural resources would result from the surface or near-surface disturbance from excavation of gravel, the laying down of gravel on the tundra for construction of the permanent facilities, and trenching. However, surveys for cultural resources are required to be conducted before excavation or any potential ground-disturbing activities could take place. Overall, given the effectiveness of the protections, and the baseline data from past inventories and research regarding where cultural sites are most likely to occur, both non-oil and gas and oil and gas-related activities within the NPR-A have a very low probability of adversely impacting cultural resources. The potential effect of climate change is the same as described for Alternative A.

4.7.13 Subsistence

4.7.13.1 Activities Not Associated with Oil and Gas Exploration and Development

Under Alternative D, non-oil and gas-related activities requiring permits from the Authorized Officer would be subject to the protective measures outlined in Chapter 2 as well as any other applicable federal, state, and North Slope Borough regulations. Activities not associated with oil and gas exploration and development include: aircraft and watercraft use; research activities, including remote camps associated with research; overland moves; and recreation. All of these activities have the potential to affect subsistence use. Refer to section 4.2.1 in Volume 2 for a detailed description of the types of non-oil and gas activities that may occur in the NPR-A.

Effects of Disturbance

Aircraft Use

Under Alternative D, the effects of aircraft use on subsistence would be the same as those described under Alternative A (section 4.3.13.1 in Volume 2). Aircraft could divert migrating or insect-avoiding caribou, as well as seals, walrus, and whales from subsistence use areas. Subsistence users have repeatedly stated during scoping meetings that aircraft traffic reduces harvest access and success (Nukapigak 1998; Ahtuanguruak 2003; Kaigelak 2003; Olemaun 2003). Disrupted harvests directly impact hunters in terms of lost time, effort, and resources (primarily fuel). Subsistence harvesters also describe the stress that occurs when they are out hunting, hear a helicopter operating nearby, and worry that the helicopter will approach and disrupt the hunt.

Watercraft Use

Under Alternative D, the effects of watercraft on subsistence harvest would be the same as those discussed under Alternative A (section 4.3.13.1 in Volume 2): localized and temporary, possibly causing subsistence species to avoid the area of activity. The low level of watercraft use is not anticipated to significantly disrupt subsistence harvesters.

Research Activities

It is likely that scientific research and data collection that is related to climate change and endangered species will continue to increase regardless of lease sales. The effects of research activities would be similar to those described under Alternative A: possible temporary and localized diversions or disturbances of subsistence species. Research activities would primarily take place in the summer months and aircraft-based research would have the greatest likelihood of affecting subsistence harvest patterns.

Recreation and Film Permits

Recreational uses of the NPR-A include hiking, rafting, canoeing, wildlife viewing and bird-watching tours that are primarily conducted by commercial guiding companies. Six to 12 recreation permits are anticipated per year. Recreation would likely be limited to summer use of river corridors. The effects of recreation under Alternative D would be similar to those under Alternative A: recreation could disturb the movements and habitat use of subsistence species, causing a short-term, localized effect. Recreational users would likely frequent waterways shared with other users, such as subsistence hunters, potentially resulting in resource user conflicts. An increase in recreation could result in increases in user conflicts and greater effect to subsistence resources along highly utilized river corridors such as the Colville and the Utukok. The effects of these conflicts on subsistence harvest patterns would likely be localized and of short duration. As described under Alternative A, effects on subsistence species and harvest patterns caused by guided hunters in the NPR-A would usually occur outside the core subsistence use areas of NPR-A communities and would be localized and temporary.

Solid and Hazardous Waste Removal and Remediation

Solid and hazardous waste removal and remediation, including the monitoring of existing clean-up sites and aging infrastructure (e.g., wellheads) would occur under Alternative D in the same manner as described in section 4.3.13.1 in Volume 2 for Alternative A. These activities would involve site characterizations, transportation of equipment over ice roads or snow trails or barge, removal of hazardous materials, possible stockpiling of contaminated materials, and eventual disposal in an appropriate facility. Effects of waste removal and remediation under Alternative D would be the same as described for Alternative A: helicopter use, ice roads, and snow trails could cause temporary and localized displacement of resources, and barging presents risks to sea mammal and bowhead whale hunting. Short-term effects could include a "plume" created by clean-up activities and an increased potential for contamination of subsistence species, particularly fish, in areas around the cleanup site. Long-term effects could include a decreased potential for contamination of subsistence species. Effects on subsistence harvest patterns by this activity would be localized and temporary, although many contaminated sites are located near NPR-A communities and can therefore affect nearby resources such as fishing areas.

Overland Moves

Overland moves, such as supply trips to communities via Rolligon in the winter on frozen tundra, would occur only by permit and would be subject to the regulations outlined in Chapter 2. The effects of overland moves under Alternative D would be similar to those described for Alternative A: caribou, grizzly bears, polar bears, muskoxen, wolves, and wolverines could be displaced from the immediate area of the travel route, but the effects would be localized and would vary depending on the intensity and frequency of traffic.

4.7.13.2 Oil and Gas Exploration and Development Activities

Effects of Disturbances

Seismic Survey Activity

Under Alternative D, it is estimated that there will be up to eight exploration-focused seismic surveys and eight production-focused surveys in the NPR-A. Approximately 31 percent more acres could be surveyed by seismic under Alternative D than under Alternative A.

The effects of seismic activity under Alternative D would be similar to those described under Alternative A (see section 4.3.13.2 in Volume 2), namely, displacement of game and disturbance of subsistence activities that can lead to loss of subsistence food; loss of time; loss of money; increased stress and anxiety; increased risk of equipment failure; and increased risk of loss of life or serious bodily injury.

Exploratory Drilling

The types of impacts from exploratory and delineation oil and gas drilling under Alternative D will be identical to those described under Alternative A in section 4.3.13.2 in Volume 2. Direct impacts to subsistence users and resources from a drilling operation would include: displacement of resources away from the drill site; possible impacts to overwintering fish from water withdrawals, river crossings, and fuel spills near ice airstrips; and increased time, effort, and expense during hunting. Ice roads and/or packed snow trails are customarily used by local residents during the winter, both by snowmobile and truck/car. The presence of these types of access may concentrate hunting efforts along the route(s). In addition, increased traffic by locals increases the likelihood that resources such as caribou will be displaced from the route.

Summer activities associated with exploratory drilling involving the use helicopters for access would result in displacement of resources due to aircraft or watercraft use; impacts to hunters from disrupted hunts; and possible increase in the amount of time, effort, and fuel needed to harvest displaced animals. Given the increase in proposed activity under Alternative D, the effects on subsistence use could be increased in extent and duration.

Development and Permanent Facilities

As compared to the other alternatives, the extent, severity, and duration of effects under Alternative D would likely be greater, given that a larger area would be open for year-round occupation and development, which would include ecologically sensitive areas that would not be open under the other alternatives. The amount of habitat loss and degradation would be greater under Alternative D than the other alternatives. The most significant change would be the availability of Teshekpuk Lake for oil and gas leasing, which is currently prohibited. It is possible that there would be some changes in caribou and waterfowl populations and distribution because of oil and gas activity in this area, despite the protective measures. Post-parturient caribou and calves could be deflected or diverted from preferred habitats in the vicinity of Teshekpuk Lake if development were to occur in that area (Murphy and Lawhead 2000). Migrating caribou could be delayed or deflected by aircraft traffic and other human activity during development and construction. Other than habitat loss and human presence, caribou could habituate to the new infrastructure and activity over time (Murphy and Lawhead 2000; USDOI BLM 2003). As discussed in section 3.4.3, "Subsistence" in Volume 1, Nuiqsut, Barrow, and Atqasuk depend on the Teshekpuk Lake Caribou Herd as a subsistence species. Even a temporary disruption of these communities' harvest patterns would have negative effects for subsistence users.

Both winter and summer oil and gas activities could result in changes to nesting and molting habitat that affect waterfowl's use of the Reserve. If temporarily displaced, waterfowl could adapt quickly to most new activities during development and construction (Johnson 2000a; Ritchie and King 2000; Sedinger and Stickney 2000). Fox populations tend to increase in response to development, as gravel pads, food waste, and other human activity provide favorable habitat and energy inputs. Foxes in turn cache waterfowl eggs and feed on fledgling and molting birds, thus reducing the breeding success of those species and in some cases depleting local populations (Burgess 2000; Sedinger and Stickney 2000).

Development in freshwater lakes could impact the population of subsistence fish. Although protective measures would minimize the possibilities of these impacts, fish and fish habitats could be affected by water withdrawals, gravel mines, changes to hydrologic regimes due to infrastructure (e.g., pads, roads, causeways, docks, bridges and culverts), increases in turbidity and salinity, oil and hazardous materials spills, and access to new habitats. These activities have the potential to reduce fish populations, divert fish from their normal locations, kill large numbers of fish, or contaminate fish populations and habitat.

As described in section 4.3.13 in Volume 2, a primary impact of oil and gas activities is the relatively high amount of aircraft use that occurs in the area during all stages of exploration, construction, and production. Subsistence hunters from all NPR-A communities have commented at scoping meetings and at NPR-A Subsistence Advisory panel meetings that air traffic spooks caribou, diverts caribou away from the area of aircraft use, reduces harvest success, and creates uncertainty and stress among subsistence hunters. These impacts are likely to be associated with any oil and gas activities that will occur under Alternative D. However, because the estimates for oil and gas activities under Alternative D are overall increased from the estimates for Alternative A, it is likely that the amount of aircraft use that is related to oil and gas research would increase and would likely occur across more areas of the Preserve. Impacts would therefore be more common and would disturb a higher number of subsistence species and subsistence harvesters. An increase in aircraft use in the Teshekpuk Lake Special Area could create a disproportionately high number of disturbances to subsistence species and harvesters.

Alternative C would impact subsistence in:

- **Wainwright:** Under Alternative D, the entirety of Wainwright's subsistence area that is managed by BLM would be available for leasing when the deferral period ends in 2014. A significant difference is that the southern NPR-A (including the Utukok River Uplands Special Area) would be available for leasing under Alternative D, whereas it would be unavailable for leasing under Alternative A. Therefore, land surrounding the Utukok River and the Kuk River's three upper tributaries (Kaolak, Avalik, and Ketik) will be made available by Alternative D. Leasing and permanent oil and gas facilities would be permitted, with extra protective measures, in the entire Utukok River Uplands Special Area/Western Arctic Herd Habitat area.
- **Point Lay:** Point Lay could be particularly impacted by the potential for leasing in the southern NPR-A. This would be a more significant difference for Point Lay than it would be for Wainwright. Point Lay subsistence users travel, hunt, and fish extensively along the Kokolik and Utukok rivers, large portions of which are located in the southern NPR-A.
- **Barrow and Atqasuk:** Alternative D would result in significantly greater risks to Barrow and Atqasuk's nearby subsistence use areas in addition to reducing protections for the Teshekpuk Lake Caribou Herd. Unlike Alternative A, Alternative D would not include special stipulations for exploration and development in critical nearby coastal waterbodies: Elson Lagoon, Dease Inlet, and Admiralty Bay.

Effects of Abandonment and Reclamation

Oil facility abandonment and reclamation activities include the removal of all equipment and facilities and the plugging of all wells. During these activities, subsistence resources and activities would be subject to impacts similar to those caused by construction as described under Alternative A (see section 4.3.13.2 in Volume 2). Following the abandonment and reclamation, subsistence resources would be subject to fewer impacts. If the gravel roads and pads were left in place and remained serviceable, they could be used by residents to access subsistence resources, possibly reducing hunting effort and time.

Effects of Spills

Although the types of effects of oil spills on subsistence resources under Alternative D are identical to those described for Alternative A in section 4.3.13.2 in Volume 2, the probability that spills would occur and that spills would occur in particularly sensitive areas is higher. Impacts would depend on the size and location of the spill: those on pads are less likely to have impacts, those on the tundra could affect small numbers of terrestrial mammals, and those that directly enter a waterbody could spread widely and be toxic to fish and waterfowl, leading to long-term, population level effects. Subsistence harvesters would likely not take caribou or other consumable resources from the general area. As described for Alternative A, the Iñupiat consider contamination from oil spills in nearshore waters to be a catastrophic possibility that would threaten their very existence (Brower 1976; Itta 2001). Impacts could include injury or death to bowhead whales and other marine mammals or a shift in the migration routes of these species. The loss of an important source of subsistence food would result in financial hardship and increased pressure on terrestrial subsistence resources. Such an event could also trigger a reduction in the International Whaling Commission subsistence bowhead whale quota, which would cause hardship for all subsistence whaling communities in Alaska, Canada's Arctic, and Chukotka.

The number of spills assumed for Alternative D is not as significant as the probability of spills occurring in Teshekpuk Lake or a coastal waterbody near Barrow, the impacts of which could be devastating. This probability is higher under Alternative D because Teshekpuk Lake would be available for leasing and there would be fewer special measures regulating oil and gas activities in Elson Lagoon, Dease Inlet, and Admiralty Bay.

4.7.13.3 Effectiveness of Stipulations and Best Management Practices

Many of the protective measures outlined in Alternative D are intended to ensure the continued health of subsistence resources and to promote a responsive relationship between subsistence users, the BLM, and oil and gas companies.

Alternative D provides important measures that are explicitly aimed at minimizing conflicts between subsistence users and other activities. H-1 is designed to prevent unreasonable conflicts by requiring that a prospective lessee/permittee consult directly with affected communities to discuss the timing, location, and methods of their proposed operations. An applicant must document its consultation efforts as part of its plan of operation and must submit the plan of operations to the National Petroleum Reserve in Alaska Subsistence Advisory Panel for review and comment. An applicant must submit said plan sufficiently early to provide time for review by the Subsistence Advisory Panel and, if necessary, for Government-to-Government consultation with Native Tribal governments. Among other items, the operations plan must describe methods the applicant will use to monitor the effects of the activity on subsistence and must describe how the applicant will keep potentially affected individuals and communities up-to-date on the activities and locations of possible conflicts with subsistence users. Whereas the objective of Required Operating Procedure H-1 under Alternative A is focused on oil and gas activities, the objective of Best Management Practice H-1 under Alternative D is expanded to reflect the fact that research and other events can also disturb subsistence areas and users.

In addition to the consultation process detailed in H-1, Best Management Practice H-2 is intended to prevent unreasonable conflicts between subsistence activities and seismic exploration by mandating that an applicant for seismic exploration shall notify local Search and Rescue operations of current and recent seismic surveys and shall notify in writing all potentially affected cabin and camp users.

Effectiveness of Stipulations and Required Operating Procedures/Best Management Practices on Subsistence Species

Many of the protective measures outlined in Alternative D are intended to minimize the surface impacts of oil and gas activities and to otherwise ensure the continued health of wildlife and subsistence resources. For a complete description of the measures under Alternative D that are designed to mitigate impacts to fish, birds, terrestrial mammals, and marine mammals, please refer to the analyses of Alternative D's impacts on those resources in this chapter. Measures that are particularly relevant to subsistence species are listed below and specific differences that would make the measures more or less effective under Alternative D are noted.

- A-4 minimizes the impacts of contaminants on fish, wildlife, and the environment, and A-11 would, for all permanent development, mandate the design and implementation of a study to monitor contaminants in subsistence foods.
- Measures that minimize disruption of caribou include E-7, K-5, and K-12. E-7, which regulates the characteristics of pipelines, would be more effective under Alternative D because it includes an additional requirement that all aboveground pipelines would have a non-reflective finish. K-12 protects habitat of the Western Arctic Caribou Herd and has no comparable provision under Alternative A.
- Alternative D has no provision comparable to K-3, which under Alternative A protects fish and wildlife habitat, subsistence cabins and subsistence activities by prohibiting all permanent oil and gas facilities on the shores of Teshekpuk Lake, Dease Inlet, Admiralty Bay and Elson Lagoon.
- Alternative D has no provision comparable to K-9, which protects Teshekpuk Lake Caribou Movement Corridors under the other alternatives.
- Alternative D has no provision comparable to K-10, which protects the Teshekpuk Lake Southern Caribou Calving Area.
- K-4a minimizes disturbance to molting geese habitat by mandating that roads will be designed to minimize impacts to molting geese. This measure is significantly weaker than K-4 under the other alternatives where it prohibits all permanent facilities except pipelines in goose molting habitat.
- K-6 is a measure that minimizes hindrance of caribou movement within caribou coastal insect-relief areas and its objective, under Alternative D, has been expanded to protect the summer shoreline habitat for polar bears, walrus, and seals. Alternative D does not include the extra provision for the coastal strip between Kogru River and Tangent Point that Alternatives B-1 and C do.
- K-11 limits permanent surface disturbance in the lease tracts in the northeast of the Teshekpuk Lake Special Area to protect subsistence resources and activities
- To protect fish habitat, B-1 and B-2 regulate water withdrawals, K-1 establishes setbacks along rivers, and C-2 to C-4 protect streams and prevent additional freeze down of deep-water pools.
- Alternative D has no provision comparable to K-8, which protects subsistence resources in the Kasegaluk Lagoon Special Area.
- E-10 minimizes the chances that migrating waterfowl will strike oil and gas facilities during low light conditions.

Unlike Alternative A, Alternative D includes a provision (Best Management Practice H-3) that minimizes impacts to important subsistence species by prohibiting employees of the oil and gas industry or other permitted activities to hunt or trap while working. This measure addresses a key concern of subsistence hunters, which is the encroachment of and competition for resources posed by outside hunters.

Effectiveness of Stipulations and Required Operating Procedures on Subsistence Harvest Patterns

In general, best management practices and lease stipulations seek to protect specific resources by establishing spatial buffer zones around facilities and infrastructure, scheduling disruptive activities when there is the least potential for conflicts with other users, making efforts to include community residents in project planning, monitoring effects on subsistence resources, and making efforts to minimize the interference of oil and gas exploration and development activities and structures with subsistence resources and users. For example, I-1 is a measure that minimizes conflicts with subsistence users by requiring orientation programs for oil and gas company employees. These programs include information on location-specific environmental, cultural, and social concerns as well as information about subsistence activities and the potential of aircraft use to disturb subsistence users.

Aircraft use near traditional subsistence cabins and campsites during spring goose and fall caribou and moose hunting is a particularly common concern. By mandating minimum flight altitudes, Best Management Practice F-1 mitigates the effects of low-flying aircraft on wildlife. This is effective when practicable and when obeyed, however, it is difficult to enforce and, as mentioned above, there are three major exemptions: wildlife surveys, foul weather, and take offs and landings. Furthermore, the BLM has no authority over private aircraft or aircraft used by projects that do not have BLM permits. BLM-chartered aircraft and aircraft use by BLM permittees accounts for a small percentage of the aircraft use in the NPR-A, therefore the BLM is not able to effectively mitigate the wider problem. The BLM has implemented a system whereby subsistence users notify the BLM of problem aircraft and the BLM attempts to track down the pilots or owners of the aircraft. Nevertheless, aircraft interference with subsistence activities continues to be a primary impact of oil and gas and other activities in the NPR-A. Several residents of Nuiqsut contend that the nuisance caused by aircraft is at such a high level that they no longer support roadless development, which was previously the preferred option. According to these residents, roads and road traffic through town would have many advantages and disadvantages, but on the whole would be preferable to the high number of overflights that the community currently endures (USDOI BLM 2010).

Several measures provide specific limitations on development near subsistence sites. Lease Stipulations K-1 and K-2 would minimize impacts to subsistence cabins and campsites and disruptions to subsistence activities by prohibiting permanent oil and gas facilities (e.g., gravel pads, roads and airstrips, and pipelines) through setbacks areas around rivers, lakes, and coastal waterbodies. Lease Stipulation K-6 is intended to minimize impacts to subsistence activities from permanent oil and facilities in coastal areas by implementing, to the extent practicable, a setback of three-quarters of a mile from the coastline and by mandating the use of previously occupied sites (e.g., Camp Lonely, various Husky/USGS drill sites, and Distant Early Warning-Line sites) when possible. Other measures that are particularly relevant to subsistence harvest patterns include:

- E-1, which requires that all roads be designed to protect subsistence use and access to traditional hunting and fishing areas.
- E-2, E-3, E-6, and E-8, which maintain subsistence use and access to traditional subsistence fishing sites.

- E-7, which mandates pipeline height to provide for the safe and unimpeded passage of subsistence hunters.
- Alternative D has no provision comparable to K-8, the measure that regulates the Kasegaluk Lagoon Special Area, the objective of which is in part to protect traditional subsistence uses and public access to and through Kasegaluk Lagoon for current and future generations of North Slope residents.

The actual effectiveness of protective measures depends heavily on their ongoing implementation, on enforcement, and on the precise location of facilities and infrastructure. Effectiveness is also dependent on the sharing of local knowledge and on informed input from residents of affected communities. As described above, several measures are designed to ensure that subsistence hunters participate in plan design. However, municipal governments and tribal governments generally have limited funding and few paid staff, and members of these organizations feel overtaxed when asked to provide meaningful input to BLM on proposed or permitted activities. This institutional overload affects subsistence users by placing increased, non-compensated demands on their time, further reducing the time available for subsistence pursuits. Many such NPR-A residents contend that the change from the prescriptive lease stipulations that were put in place by the 1998 Northeast IAP/EIS to the performance-based rules put in place by subsequent IAP/EISs forces them to spend more time defending subsistence interests because compliance is now defined in terms of meeting management objectives rather than adhering to absolute standards. The contention that it now takes more time to review and to effectively respond to industry proposals was reiterated during scoping meetings in 2010 (USDOI BLM 2010).

The BLM has found that performance-based regulations provide equal protection with greater flexibility and project relevance. The flexibility of the performance-based approach places greater reliance on on-going monitoring to ensure that regulations are in fact achieving the desired level of protection. The BLM is committed to directing the resources necessary for on-going monitoring, including support for the Subsistence Advisory Panel to provide oversight, exchange information, and develop solutions for emerging issues.

4.7.13.4 Conclusion

Although the effects of activities under Alternative D would be identical to those described for Alternative A, Alternative D makes the entire NPR-A, approximately 43 percent more than Alternative A, available for oil and gas leasing. The increased activity that could occur over a wider area could inhibit subsistence users from harvesting in their traditional use areas to a greater degree than under all other alternatives. Primary impacts could include the avoidance of traditionally used subsistence areas due to development and aircraft use as well as anxiety over this loss; the deflection of caribou and other important subsistence resources from areas of activity; increased difficulty harvesting caribou and other subsistence resources; the necessity to make longer and more distant trips in order to have a successful harvest, and the increased cost, risk, and time commitment this entails. The effects of disturbance from permanent oil and gas facilities on terrestrial mammals during the production phase would be of relatively long duration, but would be local in nature. However, decreased opportunities to harvest terrestrial mammals could be especially problematic if climate change inhibits fall travel by delaying freeze up or causes subsistence species to shift their migration routes or schedules. If climate change causes Arctic Ocean ice to retreat farther from the shore, it will make the harvesting of whales and other marine mammals more difficult, which could in turn increase pressure to harvest terrestrial subsistence foods. Under Alternative D, both winter and summer oil and gas activities could result in changes to nesting and molting habitat that affect waterfowl's use of the Reserve. Fish and fish habitats could be affected by development activities that could potentially reduce fish populations, divert fish from their normal locations, kill large numbers of fish, or contaminate fish populations and habitat.

Alternative D does not provide the same level of protection for the Teshekpuk Lake area as Alternative A does and could therefore result in an increase in impacts to the communities of Nuiqsut, Barrow and Atqasuk. Alternative D does not provide the same level of protection for the southern NPR-A as Alternative A does, which could result in impacts to the communities of Point Lay and Wainwright if development occurs in their subsistence use areas. The lower level of protection for the Western Arctic Caribou Herd under Alternative D decreases the security of the over 40 Alaskan communities that depend on those animals. Alternative D would also remove special protections provided by other alternatives for coastal waterbodies, which are particularly for important subsistence use and subsistence resource habitat. Of all the alternatives discussed in this document, Alternative D has the greatest potential to impact subsistence use.

4.7.14 Sociocultural Systems

Please refer to section 3.4.4, Sociocultural Systems for background information on cultural values, social organization, and social health in the NPR-A's Iñupiaq communities.

4.7.14.1 Activities Not Associated With Oil and Gas Exploration and Development

Under Alternative D, the effects of non-oil and gas activities on sociocultural patterns would be the same as under Alternative A. Please refer to section 4.3.14.1 in Volume 2 for a general analysis of the impacts of non-oil and gas activities on Iñupiaq sociocultural systems. The amount of research related to climate change and endangered species is likely to increase regardless of development scenarios. These research efforts and associated aircraft use could cause temporary and localized diversion or deflection of subsistence species for as long as the studies were underway. It is not expected that the amount of soil and hazardous waste removal would be greater under Alternative D than under the other alternatives or that the number of overland moves would change significantly. In general, effects from non-oil and gas activities under Alternative D would be temporary and localized, and would be unlikely to affect overall sociocultural patterns.

4.7.14.2 Oil and Gas Exploration and Development Activities

Effects of Disturbances

Oil and gas exploration, development, and production would require a seasonal network of snow and ice roads and a permanent network of production facilities, pipelines, power lines, and gravel roads, runways, and pads in the NPR-A. The types of effects of oil and gas development on sociocultural systems would be the same as under Alternative A, but the extent of industrial development in the NPR-A would be greater under Alternative D than under the other alternatives. Increases in the area available for leasing and exploration would correspond to an increase in effects to subsistence harvests as compared to those for

Alternative A. The development proposed for the NPR-A would require more staging and overland travel during the winter and in summer would require increased use of aircraft for supplies, equipment, and crew changes, as compared to the other alternatives. In all seasons, noise, lights, personnel, and traffic near oil and gas infrastructure could temporarily deflect or divert caribou in areas where activities are occurring. Gravel pads could provide caribou with insect-relief habitat, but these effects could change the distribution, timing, and location of the caribou harvest.

Subsistence hunters could be diverted from oil and gas facilities at distances from 5 to more than 25 miles, which could require increased effort and expenditure on the part of subsistence hunters. Given the high gasoline costs on the North Slope, this would add additional cost to subsistence harvests. Increased fuel costs and wear and tear on hunters and their equipment could increase the need for search and rescue missions and could increase the need for wage labor to support subsistence pursuits. This would reduce the time available to pursue subsistence activities, which would result in sociocultural consequences such as increased stress and a decreased sense of well-being. These problems are discussed in more detail in section 4.7.21, Alternative D, “Public Health.” Increases in the speed, range, and reliability of outboards and snowmobiles have facilitated the mixed subsistence and wage economy, but do not compensate for impacts to subsistence harvest activities from continued development and production activities in important subsistence harvest areas. A shift one community’s most heavily used subsistence areas may have regional sociological impacts. For example, relations in areas of overlapping subsistence use by residents of Nuiqsut, Atqasuk, and Barrow are relatively smooth, but there is a risk that that could change if Nuiqsut users are increasingly forced into the traditional and more exclusive subsistence use areas of other communities. Under Alternative D, these impacts would likely be experienced more frequently by residents of NPR-A communities.

As discussed under Alternative A, long-term change to sociocultural patterns would result from a weakening, through prolonged stress and disruptive effects, of traditional institutions that have stabilizing effects within the society. Activities occurring under this alternative would exacerbate those effects to a greater extent than activities under the other alternatives because many more culturally important and traditionally used hunting areas would be available for leasing. Such changes are already occurring on the North Slope because of migration to urban areas, onshore and offshore oil and gas development, more dependence on a wage economy, higher levels of education, improved technology, improved housing and community facilities, improved infrastructures, increased presence of non-Natives, increased travel outside of the North Slope, and increasing penetration of television and the Internet. Data from other circumpolar Inuit populations suggest that continued modernization is associated with a trend toward displacement of sociocultural systems, including: a trend toward less time being spent conducting subsistence harvest activities; less subsistence consumption among younger generations; a greater focus on a cash-based economy, as opposed to the egalitarian sharing network; an increased importance on the nuclear family, as opposed to the more-traditional extended family structure (Curtis et al. 2005; Nobmann et al. 2005; Condon et al. 1995). North Slope Borough institutions, such as the school district that promotes the teaching of Iñupiaq language and culture, the Arctic Eskimo Whaling Commission that negotiates with industry to protect Iñupiaq subsistence whaling interests, the North Slope Borough Department of Wildlife Management, and other regional and village Native corporations and organizations, have been working to prevent the weakening of traditional Iñupiaq cultural institutions and practices. A number of social impacts are associated with increased contact with outside groups; however, there currently appears to be a high level of separation, acceptance, and indifference between residents and workers in NPR-A communities. Under all alternatives, it is estimated that an influx of oil and gas workers today would represent a negligible fraction of the overall impact from modernization and the global economy.

Effects of Abandonment and Reclamation

At present, very few NPR-A residents have jobs in the oil fields (Circumpolar Research Associates 2002). Abandonment and reclamation activities would likely generate jobs for local residents for several years and at greater levels of employment than would exist during the operational phase. If local residents were to become substantially integrated into oil field operations, their families could face economic difficulty as fields were abandoned. North Slope communities, due to the support of the North Slope Borough, are already dependent on revenues associated with oil development. If no oil fields were active in the area to provide jobs and contribute economically to the local economy and government revenue, the community would face a time of economic depression, which is associated with increased social pathology in Iñupiaq communities, as discussed in section 4.7.21. The Arctic Slope Regional Corporation dividends, which are less dependent on local resource development, could provide some mitigating financial support if oil and gas revenues decrease. However, no potential avenues for maintaining income at the standards established in the oil development era have been identified. Abandonment and reclamation activities would restore habitat for caribou and other subsistence species and subsistence resources would thereafter be subject to fewer impacts, potentially improving subsistence opportunities.

Effects of Oil Spills

Under Alternative D, the likelihood of a spill event with the potential to damage unique critical habitats and subsistence use areas is greater than under the other alternatives because these sensitive areas would be available for oil and gas leasing and associated activities. The effects of oil spills would be the same as those discussed in Alternative A: effects would vary in severity depending upon the timing and location of the spill event, but fish, waterfowl, and marine and terrestrial mammals could all be affected. An oil spill could result in contamination of subsistence resources and would be a threat to the health and lifestyle of the affected communities. If a large oil spill occurred in a traditional use area, then subsistence users would have to travel further to harvest uncontaminated resources, which could result in high effects to sociocultural patterns for a much longer time than the period that subsistence resources would be measurably contaminated. An oil spill that reached coastal waters could affect the harvest of marine mammals, including bowhead whale harvests, which are at the center of Iñupiaq sociocultural organization. The preclusion of leasing in nearshore coastal waterbodies under Alternatives B-1 and B-2 is a management action that significantly reduces the threat of an oil spill in these particularly important environments.

Activities associated with cleanup of an oil spill could have an effect on sociocultural systems. In the event that a large spill contacted and extensively oiled fish and wildlife habitats, the presence of hundreds of humans, boats, and aircraft would increase the displacement of subsistence species and alter or reduce access to subsistence species by subsistence hunters. These events would supply short-term employment for local residents, potentially at the expense of subsistence activities and subsistence resource availability. Because it is expected that oil spills from activities would be small events and would normally be contained on the drill pad, effects from the spills themselves and potential disruptions from clean-up activities would be unlikely to cause excessive disturbance to sociocultural systems or the surrounding environment. A large oil spill, however, would be catastrophic to the sociocultural structure of the whaling peoples of the North Slope if it were to occur in a riverine, nearshore, or marine environment.

4.7.14.3 Effectiveness of Stipulations and Best Management Practices

The stipulations and protective measures that would be put in place under Alternative D provide the primary means of protection for subsistence species, along several rivers, and in other sensitive areas, given that 100 percent of the NPR-A would be open to oil and gas leasing. However, several stipulations common to other alternatives that serve to protect resources near Teshekpuk Lake would not apply or would be less restrictive under this alternative. Because subsistence is an inherent component of cultural values, kinship, and social health, the description of the measures under Alternative D that are relevant to subsistence species and subsistence access is also applicable to this summary of sociocultural impacts.

The BLM would continue to work with appropriate state agencies on a plan to remediate or plug Legacy Wells giving priority to public health and safety and resource protection. The BLM would also continue to work closely with responsible parties to encourage cleanup of contaminated and solid waste sites in the NPR-A, such as Former Used Defense Sites and Air Force installations. Best Management Practice H-1 provides opportunities to affected communities for participation in planning and decision making to prevent unreasonable conflicts between subsistence users and oil and gas related activities. A change that could be relevant for sociocultural issues is that Best Management Practice H-1 is expanded under Alternative D to provide for participation regarding all activities that might impact subsistence users, not just oil and gas activities. This Best Management Practice would allow NPR-A residents to be more aware of science and research projects in their region and to suggest changes or additions to those projects so that Iñupiat sociocultural systems are better served by them.

Particularly relevant for sociocultural systems is Best Management Practice I-1, which would require the lessee to provide a cultural orientation program for all oil and gas personnel involved in NPR-A activities in order to effectively minimize cultural and resource conflicts with local inhabitants. This orientation program, as it relates to subsistence pursuits and cultural concerns, would: (1) provide sufficient detail to notify personnel of applicable lease stipulations and ROPs, as well as inform them about specific types of environmental, social, traditional, and cultural concerns that relate to the region; (2) address the importance of not disturbing archaeological and biological resources and habitats, and provide guidance on how to avoid disturbance; (3) be designed to increase sensitivity and understanding of personnel to community values, customs, and lifestyles in areas where personnel would be operating; (4) include information about avoidance of conflicts with subsistence, commercial fishing activities, and pertinent mitigation; and (5) include information for aircraft personnel concerning subsistence activities and areas and seasons that are particularly sensitive to disturbance by low flying aircraft (e.g., aircraft use near traditional subsistence cabins and campsites, flights during spring goose hunting and fall moose hunting seasons, and flights near North Slope communities).

4.7.14.4 Conclusion

Alternative D makes 22.8 million acres (100 percent of the total in NPR-A) available for oil and gas leasing although current deferrals would be honored until expiration dates. This allows for development to sustain North Slope Borough revenues, and thus increases the likelihood for the continued socioeconomic support that the North Slope Borough provides in NPR-A communities. It does not alleviate the long-term issue of maintaining income at the standards established in the oil development era.

The types of sociocultural impacts that will occur as a result of the management actions of Alternative D will be these same as those of Alternative A, but would be greater in intensity as compared to the other alternatives. Increases in the amount of area available for leasing and exploration would correspond to increases in the effects to subsistence harvests as compared to those for Alternative A. If marine traffic increases in near shore areas, bowhead whales could be deflected or their behavior made more dangerous to hunters (North Slope Borough 2004). Traffic around communities could isolate the community from subsistence resource harvest areas and could prevent residents from using their homelands, subsistence cabins and camps, and unspoiled open areas for resource harvests and pursuits. This would further degrade the quality of life and connection of people with their land and environment. In addition, should harvests decrease, resources would no longer be available in amounts suitable for sharing, resulting in changes in social organization and cultural values. Areas that are of importance to subsistence users, including areas surrounding subsistence camps, critical habitat for subsistence species, and large concentrations of historic and prehistoric cultural resources, would be less protected from the impacts of oil and gas activities under Alternative D than under Alternative A. Use of these areas helps maintain family connections and a feeling of relatedness and stability, which could be threatened by the decreased protections.

While federal subsistence management responsibilities would remain unchanged under all alternatives, many subsistence users in NPR-A communities are doubtful about the consultation process and about the BLM's commitment to protecting subsistence and the subsistence culture. The BLM initiates consultation by informing interested parties of the proposed action, and inviting said parties to participate in consultation. Some NPR-A residents are frustrated by the reoccurring demands put on them to review and provide relevant comments on IAP/EISs every few years and on each industry proposal as they arise. Efforts to participate in consultation or other management processes can be seen as futile, leading to decreased participation, decreased interest in cooperation with agencies, and increased conflict between agencies, lessees, and local resident groups. The management actions that would be put in place by Alternative D could exacerbate these tensions because all culturally important areas in the NPR-A, including Teshekpuk Lake Special Area and nearshore environments, would be less secure. Alternative D disregards community subsistence concerns to a greater degree than Alternative A and thus could create more social stress and more threats to Iñupiaq sociocultural systems.

4.7.15 Environmental Justice

4.7.15.1 Activities Not Associated With Oil and Gas Exploration and Development

The non-oil and gas activities likely to occur in the planning area would primarily be transitory in nature, of short duration, and highly localized. They could temporarily divert, deflect, or disturb subsistence species from their normal patterns. Non-oil and gas activities could alter the availability of subsistence species in traditional harvest areas, which could in turn affect harvest patterns by requiring hunters to travel further in pursuit of resources. Increased travel distances would result in greater expenditures for fuel and equipment, and increased wear and tear on snowmobiles, outboards, and four-wheel vehicles, and could result in a higher risk of accidents. Consequently, there could be an effect on the subsistence hunting activities of the local minority population as a result of non-oil and gas activities. Under Alternative D, these effects would be the same as under other alternatives: minor, temporary, short term, and generally highly localized. As outlined in section 4.7.21, such effects could result in isolated problems of social pathology.

4.7.15.2 Oil and Gas Exploration and Development Activities

Effects of Disturbance

Under Alternative D, allowing oil and gas activities in areas formerly unavailable for leasing and year-round occupation could increase the amount of area affected by these activities, increase the duration of those effects, and spread the effects throughout the entirety of the NPR-A. Disturbances caused by Alternative D would be the same as those discussed under the other alternatives, but effects on subsistence caused by oil and gas development would be greater in magnitude, extent, and duration. For species unable to habituate to disturbances associated with oil and gas development, effects could potentially last for more than 40 years. Public health effects relating to sociocultural and dietary change, as well as exposure to contaminants, could persist for considerably longer.

Alternative D could have long-term effects on several terrestrial mammal species. In particular, effects on caribou herds would likely be greater than under the other alternatives. It is expected that effects on waterfowl harvested for subsistence would be more frequent and more widespread than under the other alternatives, given the greater area available for petroleum leasing. Little or no effect on marine mammals would be expected from onshore activities under Alternative D, but noise and disturbance associated with offshore barge and vessel traffic could impact bowhead whale migration patterns. There are concerns that, depending on the particular activity and, especially, the location of the activity, actions occurring under Alternative D, as under the other alternatives, could cause local effects on fish. It is believed that disruptions from Alternative D would affect caribou, waterfowl, and fish. All of these effects would be experienced primarily by the subsistence dependent minority Iñupiaq population.

Under Alternative D, the possibility of public health impacts would be greater than under the other alternatives. These impacts would occur primarily through restriction in subsistence; new access routes to the community; sociocultural and economic change; altered employment; and contaminants. Diabetes, hypertension, and related metabolic disorders would be expected to increase as subsistence is curtailed or as sociocultural changes lead to alterations in dietary patterns. Given that Alternative D involves the potential of development throughout the entire region, the risk of dietary change leading to metabolic disorders and of food insecurity are both substantially higher. The risk of contaminant-based health problems would also be highest under Alternative D, owing to the increased total emissions projected, as well as the distribution of emissions sources throughout the subsistence range. Social pathology could result from the economic changes anticipated; from increasing access to drugs and alcohol; and from stress and maladaptive coping given the impacts to wider regions of important traditional use areas. While measures such as Stipulation I-1, which mandates a cultural orientation program, should mitigate such effects, it would not be expected to entirely offset the large-scale socio-economic impacts discussed in the sociocultural and public health sections.

Effects of Abandonment and Reclamation

Abandonment and reclamation activities would likely generate jobs for local residents for several years and at greater levels of employment than would exist during the operational phase. Activities associated with dismantling and removing of production pads and facilities could disproportionately impact NPR-A residents through disturbance, displacement, and mortality of subsistence resources, through subsistence users' avoidance of areas undergoing dismantlement and removal, and through potential impacts to water, air quality, and noise. Once abandonment and reclamation were completed, NPR-A residents would be disproportionately impacted by the reduction in local and Native corporation revenues and by fewer local jobs and business opportunities. Since economic depression is associated with increased social pathology, this could result in increases in domestic violence, injury, drug and alcohol problems, and suicide. Local residents could benefit from a reduction in impacts on subsistence resources, compared to during construction and operation.

Effects of Oil Spills

As discussed elsewhere, the magnitude of effects of a crude oil spill on subsistence resources would depend on the context of the spill, the volume and area covered by spilled product, and the amount of time the product was loose before clean-up efforts commenced. Tundra oil spills could affect small numbers of terrestrial mammals and waterfowl unable to avoid the spill area, but would be unlikely to have population level effects. Oil spills (any size) directly into a water body, particularly in difficult to contain conditions such as breakup or broken ice, could spread widely and have long-term, population level effects on fish and waterfowl. In the nearshore environment, a large to very large spill, particularly during broken ice or storm conditions, could affect marine mammals including seals, and beluga and bowhead whales. Oil spills can also be associated with toxicological health effects in human populations, as outlined in section 4.7.21. Furthermore, if a large spill resulted in a substantial decrease in consumption of subsistence foods, food insecurity and hunger as well as diabetes and related metabolic disorders could increase.

As compared to the other alternatives, a greater area would be at risk for oil spill damage under Alternative D. Teshekpuk Lake itself has been unavailable for lease and/or year-round occupation under Alternative A, and oil and gas activities in the area surrounding it have been subject to significant restrictions. Although surface occupancy would be limited in the region north of Teshekpuk Lake, these areas would be open for year-round development and operation under Alternative C. Special standards for oil and gas activities in Elson Lagoon, Dease Inlet, and Admiralty Bay would no longer be in effect. Subsistence users have stated that they prefer not to hunt in industrial areas, and the communities of Barrow, Atqasuk, and Nuiqsut have harvested resources in the area to be opened under Alternative D.

The Iñupiat consider contamination from oil spills in nearshore waters to be a catastrophic possibility that would threaten their very existence, primarily because of the potential effects of spills on bowhead whales, which are a very important part of their culture in addition to being a favored food source (Brower 1976; Itta 2001). A major oil spill would result in effects that would impact Iñupiat subsistence users more than any other human group.

4.7.15.3 Effectiveness of Stipulations and Best Management Practices

Alternative D would utilize performance-based best management practices and lease stipulations. Section 4.7.13.3 describes the effectiveness of measures with regard to subsistence use under Alternative D. The lease stipulations and BMPs would be effective in reducing conflicts between subsistence uses and oil and gas activities.

4.7.15.4 Conclusion

Several lease sales have already taken place in the planning area and, because Alternative D makes 100 percent of the NPR-A available for leasing, additional exploration programs and development are expected. Effects on subsistence would continue under Alternative D, and would be greater than under the other alternatives. Most effects of disturbance would be greater in duration, extent, and magnitude. Effects from oil spills would depend greatly on the size, location, and season of the spill. Small spills on gravel pads would have little or no environmental justice effects. A major spill into a watercourse could have long-term, serious effects on Iñupiaq subsistence activities, a possibility that is more likely under Alternative D. While any major spill would have serious consequences, the worst, from an environmental justice standpoint, would be one that occurred in a key harvest area or near a community.

The activities likely under Alternative D could also have substantial health effects, as outlined above and discussed in detail in section 4.7.21. Because the population within and near the planning area is primarily comprised of Iñupiat, any health effects that occur would disproportionately affect this minority population.

4.7.16 Recreation Resources

Alternative D would allow leases to be offered for oil and gas exploration and development on 100 percent of NPR-A subsurface lands. There are 8.3 million acres that would be recognized as special areas (Teshekpuk Lake Special Area, Colville River Special Area, Utukok River Uplands Special Area, and Kasegaluk Lagoon Special Area). Another 1.57 million acres would remain deferred from oil and gas leasing until 2014; and 425,000 acres would be deferred until 2018.

4.7.16.1 Activities Not Associated with Oil and Gas Exploration and Development

Alternative D would allow the BLM to offer all of the NPR-A for oil and gas leasing. The level of non-oil and gas activity may increase under this alternative, as compared to Alternative A, as a result of a general increased interest in the area generated by the potential for more oil and gas. However, these impacts would be minimal and short-term.

4.7.16.2 Oil and Gas Exploration and Development Activities

Ice Roads, Ice pads, Airstrips, and Snow trails

Ice roads, pads, airstrips, and snow trails are temporary in nature and traversed during the winter months. Ice roads provide seasonal routes for heavy equipment supplies and movement of personnel to remote staging areas or well locations. Ice airstrips are used to transport crews and supplies to and from sites. Snow trails provide seasonal routes for use by low-ground-pressure vehicles, and are used for moving equipment, supplies, personnel accommodations, and drill rigs capable of disassembly to components small enough for transport on such vehicles. Under Alternative D, the estimated total seasonal acres impacted by ice roads, ice pads, airstrips, and snow trails is 458,003 acres or 152,668 miles. Activities in the winter would be far less visible because of the limited daylight hours. Due to the remoteness and climate of the Reserve, and typical type and frequency of recreation use taking place in the winter, there would be minimal, if any, effect from these activities.

Seismic, Exploration and Delineation Wells

Under Alternative D, seismic-survey work could take place throughout the Reserve. There could be up to 16 seismic surveys, 8 exploration-focused and 8 production-focused, for a total estimated short-term impact of 786,603 acres or 81,947 miles (see Table 4-11 in Volume 2) for surveying and camp train use under Alternative D. The surveys use low-ground-pressure vehicles to minimize potential impacts to the tundra. The typical survey lasts about 100 days. Seismic camps, which generally consist of six camp strings of five ski-mounted trailers, are typically moved every few days to once a week. On-shore seismic surveys on the North Slope are only collected in the winter. The activity would be temporary, and disturbance lasts only while the survey or camp train is passing through.

Exploration drilling that has taken place since 1999 involved no more than two drill rigs active simultaneously in the Reserve in any given season. The estimated number of drill rigs per year under Alternative D for exploration and delineation is three oil rigs and five gas rigs. While a rig could be used for multiple wells, each rig could only be used at one site at a time. Typically, drill rigs are removed from the Reserve at the end of the winter drilling season. Drilled wells are either plugged or capped for reentry at a later date. Capped wells have a pipe which would likely be less than 6 feet tall and surrounded by a 6-foot square short fence. The pipe could be a long-term impact, but would be almost unnoticeable from several hundred feet away. Approximately 1,536 acres would have short-term impacts from exploration and delineation wells under Alternative D. Recreation resources could be minimally impacted from the moving camps and associated noise from generators, aircraft, and human presence.

Activities in the winter would be far less visible because of the prevalence of darkness. Due to the remoteness and climate of the Reserve, and typical type and frequency of recreation use taking place in the winter, there would be minimal, if any, effect on recreation opportunities from these activities. The impact would be minimal, temporary, and confined to the immediate area. However, the presence of oil and gas winter activity could be beneficial to recreationists in the case of an emergency, as a means of communication and/or medical help.

Gravel Pads, Roads, and Airstrips

As part of production activities, an airstrip, camp facilities, and a storage yard would be needed. A borrow site from which to acquire gravel for pads, roads, and an airstrip may be a part of each production operation, but depending on the availability of gravel and the proximity of production operations, some borrow sites may provide gravel for multiple production operations. The only visible disturbance associated with gravel sites from borrow pits would generally only be stockpiled materials. While these sites could be large in size or footprint (about 37 acres each), very little material would remain as stockpile at any one time. Gravel mine sites from aboveground bedrock locations may produce scenic impacts if material is removed from rock outcrops within the planning area. Airstrips would usually be located near a central processing facility for transporting supplies and personnel to the field site.

While the intensity of impacts would be greatest during actual construction and development of the roads and pads, human presence, and associated activity, all could have impacts on recreation resources during the life of the activity. Because production could occur for 10 to 50 years beyond the development phase, impacts would be long-term. Impacts would be greatest within 1 mile of a road, airstrip, or gravel site, and 2 miles of a pad. The estimated disturbance for in-field gravel roads, airstrips, gravel pads, and gravel pits in Alternative D is 11,063 acres. The estimated long-term disturbance for central processing facilities, booster pump stations, compressor stations, and staging bases in Alternative D is 855 acres. The greatest impacts to recreation resources would be within 2 miles of one of these sites. At this time, it is not known what the layout of this infrastructure would be. Assuming all roads, pads, pits, and airstrips do not overlap with other infrastructure, a 1-mile impact zone for roads, airstrips, and gravel pits, a 2-mile impact zone for pads and associated facilities, the approximate total number of acres impacting recreation resources is 3,200,724 acres.

The relative proportion of the gravel roads, airstrips, and pads to the Reserve size is minimal. Once built, they would be used year-round. Due to the climate of the Reserve, recreationists would be more likely to see the roads in the summer than winter. However, since this infrastructure would be a part of production activities, they would most likely be off limits to the public. Displacement of recreationists from these areas would adversely affect recreationists' experiences and desired beneficial outcome from use of the public lands. However, the degree of the effect would depend on the actual location of the infrastructure; generally, infrastructure distant from routes of travel by recreationists would have little to no effect on recreationists.

The discovery and development of commercial fields is likely to occur gradually across the NPR-A. During production, there would be a production pad, which could potentially support dozens of wells and contain a large central processing facility for an oil field or a combined central processing facility and gas compressor facility for a gas field.

The central processing facility would typically include living quarters and offices, maintenance shops, storage tanks for fuel and water, power generators, waste-treatment units, a communications center, communication towers, aircraft towers, and compressors for gas and water reinjection. They would be constructed as transportable modules, which would be supported above the ground on pilings to accommodate ground settling or frost heaving. Communication towers could be as high as 200 feet and well lit.

Recreation resources could be affected by possible displacement, if the activity were to take place at a site previously used for recreation. The actual effects would depend greatly on where development fields were located. The oil and gas facilities, equipment, noise, night lighting, and human activity could alter the recreation setting to an industrial setting, which would interfere with recreationists' goals, and influence their opportunities, activities, experiences, and benefits.

Pipelines

The production operation would include feeder lines, regional pipelines, booster pump (oil) or additional compression stations (gas), a high-pressure gas trunk line, a gas conditioning facility and an oil-sale and/or gas-sale pipeline to transport the resource to market. The actual locations of new pipelines in the NPR-A would depend on the location and sequence of commercial-sized discoveries. Aboveground pipelines for oil would be the preferred method, while gas pipelines would be underground.

Oil pipelines would create a minor visual impact to recreationists who happen to see them, for the length of time that they are in view. While gas pipelines would not be visible, vegetation over the gas pipelines would indicate their location. The dirt work involved with underground pipelines could leave a change in the vegetation (see section 4.7.5, "Vegetation") that would benefit recreationists by creating an easier walking area. Pipelines and associated human activity could alter the recreation setting to an industrial setting, which would interfere with recreationists' goals, and influence their opportunities, activities, experiences and benefits.

Once built, a pipeline would have a long-term impact on the area. Due to the climate of the Reserve and typical recreation activity, a pipeline would be more likely to be seen in the summer months than the winter months.

The estimated long-term disturbance for gathering or feeder lines, gas pipelines and oil pipelines in Alternative D is 3,747 acres and 15,343 acres in the short term. Short-term impacts would be minimal, temporary, and confined to the immediate area (i.e., within approximately one-half mile in any direction). Assuming a 1-mile impact zone on either side of pipelines (which are above ground), the total long-term impacts to recreation resources from oil and gas pipelines would be approximately 3,499,520 acres.

4.7.16.3 Effectiveness of Stipulations and Best Management Practices

Although the lease stipulations and best management practices of Alternative D do not specifically address recreation resources, many of the lease stipulations and best management practices of Alternative D would serve to protect recreation resources such as Best Management Practices A-1 through A-7, A-9, B-1, B-2, C-4, E-6, E-7, E-8, and F-1, and Lease Stipulations D-1, E-2, E-3,K-1, and K-2. In addition, approximately 8.3 million acres would be classified as special areas, further protecting recreation resources in the Reserve. Table 2–3 in Volume 1, Chapter 2 has a description of the stipulations and required operating procedures. These lease stipulations and best management practices help protect recreation resources by protecting the natural environment and the resources that recreationists may be interested in such as fish, mammals, birds, vegetation, and water.

4.7.16.4 Conclusion

The impacts from activities not associated with oil and gas on recreation resources would be minimal, seasonal, confined to the immediate area, and present only during the activity for Alternative D. About 786,603 acres or 81,947 miles is expected to be impacted short-term by seismic activities, 458,003 acres or 152,668 miles of seasonal impacts by the construction of ice roads or airstrips and snow trails, and 2,391 acres short-term impacts by exploration and delineation wells, as described in the oil and gas scenarios above. However, due to the remoteness and climate of the Reserve, and typical type of recreation use taking place in the winter, there would be minimal, if any, effect on recreation opportunity from these activities.

The approximate total number of acres impacting recreation resources from gravel pads, roads, and airstrips is 2,996,894 acres. Long-term acres impacted by drilling production, service wells and pipelines are approximately 3,916,836 acres (16,051 acres short term). These activities could displace recreationists, and thus, adversely affect their experiences and desired beneficial outcome from use of the public lands. However, the degree of the effect would depend on the actual location of the activities and their relationship to recreation opportunities. Pipelines, production activities, and associated human activity could alter the recreation setting to an industrial setting, which would interfere with recreationists' goals, and influence their opportunities, activities, experiences, and benefits.

Alternative D would have the most seismic acres used, the most winter activities, and the highest percentages of use of the Reserve. Alternative D is the only alternative that would allow oil and gas leasing to take place in the southern area of the Reserve, where the most special recreation permit activities currently takes place. However, the U.S. Geological Survey indicates that, based on economics, no development would occur in the southern portion of the NPR-A. The biggest difference among the alternatives is the total amount of activity that affects recreation resources and the associated acreage, as all the alternatives would have similar impacts. The total estimated long-term potential acres impacting recreation resources from Alternative A is 4,305,514 acres; Alternative B-1, 3,737,048 acres; Alternative B-2, 4,056,216 acres; Alternative C, 6,630,163 acres; and Alternative D, 7,111,639 acres.

As the climate gets warmer in the NPR-A (Scenarios Network for Alaska Planning 2010), the timing of recreation activities would change. Summer recreation activities could take place for a longer time period and winter activities for a shorter timeframe. Warmer and longer summers could increase the demand for recreation use of the area. Climate change could affect the caribou migration patterns, which would also change the location of guided special recreation permit activity taking place. According to the Scenarios Network for Alaska Planning fire map, there would be an increase in fires in the southern portion of the NPR-A. The fires could displace special recreation permit permittees.

4.7.17 Wild and Scenic Rivers

Under Alternative D, none of the 12 eligible rivers described in section 3.4.8 would be found suitable and recommended for inclusion in the National Wild and Scenic Rivers System. This is similar to the situation in Alternative A.

Oil and gas leasing would not be prohibited from any of the eligible river areas. The entire NPR-A would be managed as Visual Resource Management Class IV.

4.7.17.1 Activities Not Associated With Oil and Gas Exploration and Development

Free Flow and Water Quality: The 12 eligible rivers would remain free flowing and free of pollution from impacts resulting from non-oil and gas activities the same as described for Alternative A, because non-oil and gas activities would not be sufficient to cause noticeable impacts.

Outstandingly Remarkable Values: There are no notable impacts to outstandingly remarkable values identified for the 12 eligible rivers from non-oil and gas activities under Alternative D. Paleontological resources would continue to be studied and there is some chance that unauthorized removal of paleontological resources might occur at a similar level to the current situation. Studies impact a few square meters of surface, and resource theft, while it is known to occur, is uncommon, and law enforcement efforts in this area are thought to provide deterrence. Wildlife resources along the rivers might be disturbed to a very minor extent by recreational visitors and by aircraft. Recreational activity will likely continue at current levels. Recreational activities along the eligible rivers would not be noticeably impacted by other non-oil and gas activities in the area. Subsistence resources and access would not be impacted by non-oil and gas activities along the eligible streams. Scenery in the area would not be changed by non-oil and gas activities.

4.7.17.2 Oil and Gas Exploration and Development Activities

The 12 eligible rivers are in areas of low potential for exploration and development. In general, the impacts to river values under Alternative D would be about the same as those described for Alternative A. Still, under Alternative D, 1,135 eligible river miles would be available for leasing that would not be available under Alternative A. While K-1 and K-12 protections would effectively protect river values to some degree, potential impacts to free flow, water quality, and outstandingly remarkable values of the eligible rivers could be marginally greater than in Alternative A. Aircraft overflights of eligible rivers might increase from oil and gas activities, and if this happens, there would be some impact to recreation and subsistence. Recreation experiences would be less primitive, and subsistence hunts could be disrupted by such overflights.

4.7.17.3 Effectiveness of Stipulations and Required Operating Procedures

Required Operating Procedures A-2 through A-7 reduce risks to water quality impairment through procedures for handling potential pollutants, preventing spills, and responding to spills. Setbacks in K-1 should be effective in reducing potential pollution and visual impacts to all eligible streams. In addition, Best Management Practice C-2 would protect stream banks from compaction and E-16 would prohibit removal of more than 100 cubic yards of sand or gravel from cliffs, and any extraction of sand or gravel near streams would require studies that would indicate there would be no potential impacts to the integrity of the river bluffs. Stipulation K-12 would provide protection for the wildlife values (caribou) near the eligible rivers.

4.7.17.4 Conclusion

There would be few direct or indirect impacts to the Wild and Scenic River values of the 12 eligible rivers under Alternative D. The eligible river area most likely to be impacted is the Utukok, which could be impacted by a potential Chukchi Sea development corridor. The Utukok would be available for leasing (see Table 4-20 in Volume 2) and lies within the potential Chukchi Sea development corridors under Alternative D.

The eligible river segments in the Utukok Uplands Special Area would be protected by K-12; this would include Carbon Creek, the middle portion of the Utukok, the upper portion of the Colville, the lower part of the Nuka, the upper portion of the Awuna, and the upper section of the Kokolik. Adverse impacts to free flow, water quality, and outstandingly remarkable values for these three streams would be somewhat more likely than under Alternative A, although the potential for development activities, including roads and pipelines in these areas are low.

All eligible rivers would be subject to stipulations and required operating procedures, including Required Operating Procedures A-2 through A-7, and K-1, which would reduce the potential for pollution and visual impacts. Values would be protected by stipulations and best practices and by the fact that development or installation of infrastructure in these river areas is largely prohibited, and development potential is extremely low throughout the southern area. There would be no impacts to wild river values of eligible rivers within the planning area as direct or indirect impacts of this alternative. Eligibility for inclusion in the National Wild and Scenic Rivers System in the future through impacts to free-flow, water quality, or outstandingly remarkable values would not be foreclosed.

Climate change might impact the vegetation and soils along the eligible streams, most noticeably by the intrusion of taller shrubs and thawing permafrost. This would impact the accessibility and scientific values of cultural sites by hiding them, and change the scenic quality of the areas viewable from the stream by limiting vistas. It is possible that melting permafrost could increase sedimentation and turbidity in these streams, reducing water quality.

4.7.18 Wilderness Characteristics

Alternative D would allow leases to be offered for oil and gas exploration and development on 100 percent of NPR-A subsurface lands. Another 1.57 million acres would remain deferred from oil and gas leasing until 2014; and 425,000 deferred until 2018. There would be 8.3 million acres recognized as Special Areas (Teshekpuk Lake Special Area, Colville River Special Area, Utukok River Uplands Special Area, and Kasegaluk Lagoon Special Area).

4.7.18.1 Activities Not Associated with Oil and Gas Exploration and Development

Alternative D would allow the BLM to offer all of the NPR-A for oil and gas leasing. The level of non-oil' and gas activity may increase under this alternative as compared to Alternative A, as a result of a general increased interest in the area generated by the potential for more oil and gas. However, these impacts would be minimal and short term. Overall, the impacts to wilderness characteristics from non-oil and gas activities under Alternative D are insignificant for the planning area.

4.7.18.2 Oil and Gas Exploration and Development Activities

Seismic Surveys

Under Alternative D, seismic-survey work could take place throughout the Reserve. There could be an estimated up to 16 seismic surveys, 8 exploration-focused and 8 production-focused, for a total estimated short-term disturbance of 786,600 acres (see Table 4-11 in Volume 2) for surveying and camp train use under Alternative D. The surveys use low-ground-pressure vehicles to minimize potential impacts to the tundra. The typical survey lasts about 100 days. Seismic camps, which generally consist of six camp strings of five ski-mounted trailers, are typically moved every few days to once a week. Wilderness characteristics could be minimally impacted from the moving camps and associated noise from generators, aircraft, and human presence. The impact would be minimal, temporary, and confined to the immediate area (i.e., within approximately 0.5 mile in any direction).

A longer lasting impact could be to vegetation resulting from seismic survey operations (see section 4.7.5) impacting naturalness and scenic values. The color contrast would be minimal from ground view and almost nonexistent from more than a few hundred feet away. After 8 to 9 years, the evidence of use would be minimal. Seismic operations by their nature do not follow the same routes every year and the number of miles of survey line run can vary greatly from year to year.

Ice Roads, Pads, Airstrips, and Snow Trails

Ice roads, pads, airstrips, and snow trails are temporary in nature and traversed during the winter months. Ice roads provide seasonal routes for heavy equipment supplies, and movement of personnel to remote staging areas or well locations. Ice airstrips are used to transport crews and supplies to and from sites. Snow trails provide seasonal routes for use by low-ground-pressure vehicles and used for moving equipment, supplies, personnel accommodations, and drill rigs capable of disassembly to components small enough for transport on such vehicles. The estimated total seasonal acres disturbed by ice roads, ice pads, airstrips, and snow trails are 458,003 acres. The wilderness characteristics of naturalness and opportunities for solitude or primitive and unconfined recreation could be minimally impacted from the associated noise from generators, aircraft, and human presence. The impact would be minimal, temporary, and confined to the immediate area (i.e., within approximately 0.5 mile in any direction).

Exploration and Delineation Wells

Exploration drilling that has taken place since 1999 involved no more than two drill rigs active simultaneously in the Reserve in any given season. The estimated number of drill rigs per year under Alternative D for exploration/delineation is three oil rigs and five gas rigs. While a rig could be used for multiple wells each rig could only be used at one site at a time. Typically, drill rigs are removed from the Reserve at the end of the winter drilling season. Drilled wells are either plugged or capped for reentry at a later date. The wilderness characteristics of naturalness and outstanding opportunities for solitude or primitive and unconfined recreation could be minimally impacted from the associated noise from generators, vehicles, and human presence. Approximately 1,536 acres would have short-term disturbance from exploration and delineation wells under Alternative D. The impact would be minimal, temporary, and confined to the immediate area (i.e., within approximately 0.5 mile in any direction). For well sites that are capped, a wellhead would remain on site. Due to the remoteness and expansiveness of the Reserve a capped well head would not impact wilderness characteristics.

Gravel Pads, Roads, and Airstrips

As part of production activities an airstrip, camp facilities, and a storage yard would be needed. A borrow site from which to acquire gravel for pads, roads, and an airstrip may be a part of each production operation, but depending on the availability of gravel and the proximity of production operations, some borrow sites may provide gravel for multiple production operations. The only visible disturbance associated with gravel sites from borrow pits would generally only be stockpiled materials. While these sites could be large in size or footprint (about 37 acres each), very little material would remain as stockpile at any one time. Gravel mine sites from aboveground bedrock locations may produce visual impacts if material is removed from rock outcrops within the planning area. Air strips would usually be located near a central processing facility for transport of supplies and personnel to the field site.

While the intensity of impacts would be greatest during actual construction and development of these facilities, remaining structures (i.e., roads, pads, airstrips), human presence and associated activity and noise all would have impacts on wilderness characteristics during the life of the activity. Because production could occur for 10 to 50 years beyond the development phase, impacts to wilderness characteristics of naturalness, outstanding opportunities for solitude or primitive and unconfined recreation, and scenic supplemental values would be long term. These impacts would be greatest within 1 mile of a site. The estimated disturbance for in-field gravel roads, airstrips, gravel pads, and gravel pits in Alternative D is 11,063 acres. The estimated long-term disturbance for central processing facilities, booster pump stations, compressor stations and staging bases in Alternative D is 865 acres. The greatest impacts to wilderness characteristics would be within 2 miles of one of these sites. At this time, it is not known what the layout of this infrastructure would be. Assuming all roads, pads, pits and airstrips do not overlap with other infrastructure; a 1-mile impact zone for roads, airstrips, and gravel pits; a 2-mile impact zone for pads and associated facilities; the approximate total number of acres impacting wilderness characteristics is 3,407,315 acres. The BLM can require removal of gravel roads/pads/airstrips after the life of the activity, or could decide to allow them to remain forever, which would have a permanent impact on wilderness character. If these activities impair wilderness characteristics in the future the areas would be excluded from the inventory of lands with wilderness characteristics.

The discovery and development of commercial fields is likely to occur gradually across the NPR-A. During production, there would be a production pad, which could potentially support dozens of wells and contain a large central processing facility for an oil field or a combined central processing facility/gas compressor facility for a gas field.

The central processing facility would typically include living quarters and offices, maintenance shops, storage tanks for fuel and water, power generators, waste-treatment units, a communications center, communication towers, aircraft towers, and compressors for gas and water reinjection. They would be constructed as transportable modules, which would be supported above the ground on pilings to accommodate ground settling or frost heaving. Communication towers could be as high as 200 feet and well lit.

Pipelines

The production operation would include feeder lines, regional pipelines, booster pump (oil) or additional compression stations (gas), a high pressure gas trunk line, a gas conditioning facility and an a oil-sale and/or gas-sale pipeline to transport the resource to market. The actual locations of new pipelines in NPR-A would depend on the location and sequence of commercial-sized discoveries. Aboveground pipelines for oil would be the preferred method while gas pipelines would be underground. Because production could occur for 10 to 50 years beyond the development phase, impacts to wilderness characteristics of naturalness, outstanding opportunities for solitude or primitive and unconfined recreation, and scenic supplemental values would be long term. The estimated long-term usage for gathering/feeder lines, gas pipelines, and oil pipelines in Alternative D is 3,802 acres, with 16,051 acres short-term use. Short-term impacts would be minimal, temporary, and confined to the immediate area (i.e., within approximately 0.5 mile in any direction). Assuming a 1-mile impact zone on either side of pipelines, the total long-term impacts to wilderness characteristics from oil and gas pipelines would be approximately 3,704,320 acres. If these activities impair wilderness characteristics in the future, the areas would be excluded from the lands with wilderness characteristics inventory.

4.7.18.3 Effectiveness of Stipulations and Best Management Practices

Although the lease stipulations and best management practices do not specifically address wilderness characteristics and the BLM is not considering recommending designation of wilderness in the planning area, many of the standards required for development of Alternative D would serve to protect wilderness characteristics including A-1 through A-7, B-2, C-2, C-3, E-1, E-4, E-13, and F-1, and lease stipulations D-1, D-2, and G-1. In addition, approximately 8.3 million acres would be classified as special areas, further protecting wilderness characteristics in the Reserve. Table 2–3 in Volume 1, Chapter 2 has a description of the stipulations and required operating procedures/best management practices. These lease stipulations and best management practices help protect wilderness characteristics by protecting the natural environment and resources such as fish, mammals, birds, vegetation, and water.

4.7.18.4 Conclusion

The impacts from activities not associated with oil and gas on wilderness characteristics from Alternative D would be minimal, confined to the immediate area, and for the most part concurrent with activities. Total short-term acres disturbed for Alternative D as described in the oil and gas scenarios for seismic activities would be approximately

1,274,720 acres. However, there may be evidence of the seismic activity for 8 to 9 years. About 458,003 acres is expected to be disturbed by the construction of ice roads, ice pads, airstrips, and snow trails and 1,536 acres by exploration and delineation wells as described in the oil and gas scenarios above. The impact would be minimal, temporary, and confined to the immediate area.

The approximate total number of acres impacting wilderness characteristics from gravel pads, roads, and airstrips is 3,357,200 acres. Long-term acres impacted by drilling production, service wells and pipelines are approximately 3,916,836 acres (16,051 acres in the short term). If these activities impair wilderness characteristics in the future, the areas would be excluded from the inventory of lands with wilderness characteristics.

Disturbance from long-term, seasonal and short-term actions could potentially impact approximately 8.8 million of the NPR-A's nearly 23 million acres in a manner that could impair wilderness characteristics. Of the remaining 14.2 million acres in the NPR-A, 8.3 million acres of lands with wilderness characteristics would be protected by prior special designation or by being unavailable for leasing and development. The balance of the lands with wilderness characteristics, 5.9 million acres, would not have measures taken to specifically protect lands with wilderness characteristics, but are not anticipated to be subject to actions that would cause wilderness characteristics to be lost.

The impacts on wilderness characteristics would be similar for all alternatives. The biggest difference between the alternatives in relation to wilderness characteristics is the total amount of activity that would take place under each alternative. Alternative D would have the most seismic acres used, the most winter activities and the highest percentages of use of the Reserve. Alternative D is the only alternative that would allow oil and gas leasing to take place in the southern area of the Reserve. However, the USGS indicates that based on economics, no development would occur in the southern portion of the NPR-A. The total estimated potential long-term acres impacting wilderness characteristics from Alternative A is 4,305,514 acres; Alternative B-1, 3,737,048 acres; Alternative B-2, 4,056,216 acres; Alternative C, 6,471,253 acres; and Alternative D, 7,111,639 acres.

The supplemental values than an area may contain of ecological, geological, or other features of scientific, education, scenic, or historical value may be affected if the climate continues to warm in the NPR-A (Scenarios Network for Alaska Planning 2010). See climate sections within the Physical Environment and Biological Resources sections of Chapter 3 for more information.

4.7.19 Visual Resources

Under Alternative D, all of the NPR-A would be designated VRM Class IV (Map 2-5).

4.7.19.1 Activities Not Associated with Oil and Gas Exploration and Development

Alternative D would allow the BLM to offer all of the NPR-A for oil and gas leasing. The level of non-oil and gas activity may increase under this alternative as compared to Alternative A, as a result of a general increased interest in the area generated by the potential for more oil and gas. However, these impacts would be minimal and short term.

4.7.19.2 Oil and Gas Exploration and Development Activities

Seismic Surveys

Under Alternative D, seismic-survey work could continue throughout the Reserve. There could be up to 16 seismic surveys, 8 exploration-focused and 8 production-focused, under Alternative D for a total of estimated 786,600 acres impacted by surveying and camp train use. The surveys use low-ground-pressure vehicles to minimize potential impacts to the tundra. The typical survey lasts about 100 days. Seismic camps, which generally consist of six camp strings of five ski-mounted trailers, are typically moved every few days to once a week.

On-shore seismic surveys on the North Slope are only collected in the winter; therefore, the colors of structures and equipment would have a weak contrast with the white color of the snow-covered landscape. Activities in the winter would be far less visible due to the limited hours of daylight, although lights on equipment would be visible when the equipment is passing through an area. Due to the remoteness and climate of the Reserve, the casual observer would not likely be present to be affected visually by the seismic activity. Local subsistence users could be traveling on the tundra and observe the seismic activity (see section 4.7.13). Visual resources could be minimally impacted from the moving camps and, aircraft, and human presence.

The seismic operations would have a moderate contrast to the landscape character element of line. In Visual Resource Management terms, the definition of moderate is: The element contrast begins to attract attention and begins to dominate the characteristic landscape (H-8431-1). The seismic equipment would represent a bold line on a large mass of continuous white.

A longer lasting visual impact could be to vegetation resulting from seismic survey operations (see section 4.7.5). Because trails visually modify existing vegetation, they would not produce much contrast to line, form, or texture. The color contrast would be minimal from ground view and almost nonexistent from more than a few hundred feet away. After 8 to 9 years, the evidence of use would be minimal. Seismic operations by their nature do not follow the same routes every year and the number of miles of survey line run can vary greatly from year to year.

Ice Roads, Pads, Airstrips, and Snow Trails

Ice roads, ice pads, airstrips, and snow trails are temporary in nature and traversed during the winter months. Ice roads provide seasonal routes for heavy equipment supplies, and personnel accommodations moving to remote staging areas or well locations. Ice airstrips are used to transport crews and supplies to and from sites. Snow trails provide seasonal routes for use by low-ground-pressure vehicles and used for moving equipment, supplies, personnel accommodations, and drill rigs capable of disassembly to components small enough for transport on such vehicles.

Activities in the winter would be far less visible due to the limited hours of daylight, although lights on equipment would be visible when the equipment is passing through an area. Due to the remoteness and climate of the Reserve the casual observer would not likely be present to be affected visually by this activity. Local subsistence users could be traveling on the tundra and observe the activity (see section 4.7.13). Visual resources could be minimally impacted from the moving camps, aircraft, and human presence. The estimated total seasonal acres impacted by ice roads, ice pads, airstrips, and snow trails are 458,003 acres.

Exploration and Delineation Wells

Exploration and delineation wells are typically drilled in the winter in the Reserve. Exploration drilling since 1999 involved no more than two drill rigs active simultaneously in the Reserve in any given season. The estimated number of drill rigs per year under Alternative D for exploration/delineation is three oil rigs and five gas rigs. While a rig could be used for multiple wells, each rig could only be used at one site at a time. Typically, drill rigs are removed from the Reserve at the end of the winter drilling season. Drilled wells are either plugged or capped for reentry at a later date. Capped wells have a pipe, which would likely be less than 6 feet tall and surrounded by a short fence 6 feet square. The pipe could be a long-term impact, but would be almost unnoticeable from several hundred feet away. Approximately 1,536 acres would have short-term impacts from exploration and delineation wells under Alternative D.

Activities in the winter would be far less visible due to the limited daylight hours, although lights on equipment would be visible when the equipment is passing through an area. Due to the remoteness and climate of the Reserve the casual observer would not likely be present to be affected visually by this activity. Local subsistence users could be traveling on the tundra and observe the activity (see section 4.7.13). Visual resources could be minimally impacted from the moving camps, aircraft, and human presence.

Gravel Pads, Roads, and Airstrips

As part of production activities an airstrip, roads, camp facilities and a storage yard could be needed. A borrow site from which to acquire gravel for pads, roads, and an airstrip may be a part of each production operation, but depending on the availability of gravel and the proximity of production operations, some borrow sites may provide gravel for multiple production operations. The only visible disturbance associated with gravel sites from borrow pits would generally only be stockpiled materials. While these sites could be large in size or footprint (about 37 acres each), very little material would remain as stockpile at any one time. Gravel mine sites in the NPR-A from aboveground bedrock locations may produce visual impacts if material is removed from rock outcrops. This mining activity would change the form of the natural landscape and may be visible from the Foreground-Middleground Zone. Airstrips would usually be located near a central processing facility for transport of supplies and personnel to the field site.

While the intensity of impacts would be greatest during actual construction and development of the roads and pads, human presence and associated activity could also have impacts on visual resources during the life of the activity. The landscape of the Reserve is homogeneous, with little visual variety and contrast. Therefore, building a road would be expected to cause a weak amount of contrast to the form of the land. In Visual Resource Management terms, the definition of weak is: The element contrast can be seen, but does not attract attention (H-8431-1). It would minimally impact the landscape character element of line through introduction of the location and road, both of which would be visible linear features. Exposing the soil would cause a weak impact to the color in the landscape.

The texture of the exposed soil would be smoother than the existing landscape, thus creating a weak contrast. When an application is received for a road, a visual contrast rating would be completed to determine the actual contrast, along with a visual simulation and mitigation measures would be determined to maintain the appropriate Visual Resource Management class.

Because production could occur for 10 to 50 years beyond the development phase, impacts would be long term. These impacts would be greatest within 1 mile of a site. The estimated disturbance for in-field gravel roads, airstrips, gravel pads, and gravel pits in Alternative D is 11,662 acres. The estimated long-term use for central processing facilities, booster pump stations, compressor stations and staging bases in Alternative D is 865 acres. The greatest impacts to visual resources would be within 2 miles of one of these sites. At this time it is not known what the layout of this infrastructure would be. Assuming all roads, pads, pits, and airstrips do not overlap with other infrastructure; a 1-mile impact zone for roads, airstrips, and gravel pits; a 2-mile impact zone for pads and associated facilities; about 3,407,315 acres would be impacted. The relative proportion of the roads, airstrips, and pads to the Reserve size is minimal. Once built, the roads would be used year-round. Due to the climate of the Reserve, the casual observer would be more likely to see the roads in the summer than winter. The impact associated with the graveled pads and roads would be moderate long term, and confined to the 1- and 2-mile impact zones.

The discovery and development of commercial fields is likely to occur gradually across the NPR-A. During production, there would be a production pad, which could potentially support dozens of wells and contain a large central processing facility for an oil field or a combined central processing facility/gas compressor facility for a gas field.

The central processing facility would typically include living quarters and offices, maintenance shops, storage tanks for fuel and water, power generators, waste-treatment units, a communications center, communication towers, aircraft towers, and compressors for gas and water reinjection. They would be constructed as transportable modules, which would be supported above the ground on pilings to accommodate ground settling or frost heaving. Communication towers could be as high as 200 feet and well lit.

The blocky, rectangular form of the structures would contrast strongly with the existing landscape. In VRM terms the definition of strongly is: The element contrast demands attention, will not be overlooked, and is dominant in the landscape (H-8431-1). They would introduce distinct vertical lines, which would strongly contrast with the existing horizontal landscape. The smooth texture of the structures would strongly contrast with the coarser texture of the surrounding vegetation. Potential impact would include artificial light and associated sky glow from winter drilling. This lighting would degrade scenic quality by introducing intrusive, artificial lighting into an otherwise unlit natural landscape that would be visible from a distance of approximately 17 miles (based on a 200-foot tower, calculated mathematically).

Visual resources would be minimally impacted long term, and confined to the area of view. The actual effects would depend greatly on where development fields were located.

Pipelines

The production operation would include feeder lines, regional pipelines, booster pump (oil) or additional compression stations (gas), a high-pressure gas trunk line, a gas conditioning facility and an oil-sale and/or gas-sale pipeline to transport the resource to market. The actual locations of new pipelines in the NPR-A would depend on the location and sequence of commercial-sized discoveries. Aboveground pipelines for oil would be the preferred method while gas pipelines would be underground.

Building a pipeline would cause a strong amount of contrast to the form of the land. It would moderately impact the landscape character element of line through introduction of the location and pipeline, both of which would be visible linear features. Exposing the soil would cause a weak impact to the color in the landscape. The texture of the exposed soil would be smoother than the existing landscape, thus creating a weak contrast. Once the pipeline is built it would have a moderate contrast with the form of the land. The NPR-A has many lakes of various sizes and shapes. A pipeline crossing the lakes would create a moderate contrast. The color contrast would depend on the color of the pipeline. Assuming the pipeline is grayish silver, there could be a moderate contrast with the colors in the landscape. The texture of the pipeline would be smooth compared to the existing landscape.

Once built, a pipeline would have a long-term impact on the area, being more visible in the summer months than the winter months. The estimated long-term disturbance for gathering/feeder lines, gas pipelines, and oil pipelines in Alternative D is 3,802 acres, 16,051 acres short term. Assuming a 1-mile impact zone on either side of pipelines, the total long-term impacts to visual resources from oil and gas pipelines would be approximately 3,704,320 acres. Visual resources would be moderately impacted long term, but confined to the 1- and 2-mile impact zones. The actual effects would depend greatly on where development fields were located.

4.7.19.3 Effectiveness of Stipulations and Best Management Practices

Although the lease stipulations and best management practices do not specifically address visual resources, many of the standards required for development of Alternative D would serve to protect visual resources including A-1through A-7, C-2, C-3, E-1, E-5, and E-15, and lease stipulations D-1, D-2, and G-1, by regulating overland moves, seismic work, exploratory drilling, facility design, construction and siting of facilities, water use, minimize impacts to solid and hazardous waste, minimize contaminants and the protection of stream banks. In addition, approximately 8.3 million acres would be classified as Special Areas further protecting visual resources in the Reserve. Table 2–3 in Chapter 2, Volume 1, has a description of the stipulations and best management practices. These lease stipulations and best management practices help protect visual resources by protecting the natural environment and resources such as fish, mammals, birds, vegetation, and water.

4.7.19.4 Conclusion

Under Alternative D, the impacts from activities not associated with oil and gas on visual resources would be minimal, confined to the immediate area, and for the most part concurrent with activities. Total short-term acres disturbed for Alternative D as described in the oil and gas scenarios for seismic activities would be approximately 786,600 acres. However, there may be evidence of the seismic activity for 8 to 9 years. About 458,003 acres would be expected to be disturbed by the construction of ice roads, ice pads, airstrips, and snow trails, and 1,536 acres by exploration and delineation wells as described in the oil and gas scenarios above. The impacts would be minimal, temporary, and confined to the immediate area

The approximate total number of acres impacting visual resources from gravel pads, roads, and airstrips is 3,194,803 acres. Long-term acres impacted by drilling production, service wells and pipelines are approximately 3,916,836 acres, 16,051 acres in the short term. The impact would be moderate long term, and confined to the 1- and 2-mile impact zones. When an application is received for these kinds of activities a visual simulation would be conducted for the NEPA analysis for each project, which would determine the actual impact expected and any mitigation measures.

Climate change could affect visual resource values by altering the current conditions of color, vegetation, adjacent scenery, and the presence of water. Shifts in public sensitivity could occur as well. The biggest difference between the alternatives is the total amount of activity that affects visual resources, because all the alternatives would have similar types of impacts. Disturbance from long-term, seasonal, and short-term actions could potentially impact approximately 6 million of the NPR-A's nearly 23 million acres in a manner that could impair visual resources. Alternative D would have the most seismic acres used, the most winter activities, and the highest percentages of use of the Reserve. The acres impacted with this alternative are more than the other alternatives. The more long-term surface disturbance, the more visual contrast occurs. The larger the scale of the disturbance, the more contrast as well.

The Visual Resource Management classes determined in Alternative D would create equal lands in Class I, less Class II, less Class III, and more Class IV (100 percent) than the visual resource inventory.

Alternatives A, B-1, and C would create more lands as Class I than the visual resource inventory; Alternatives B-2 and D would create the same amount (none). All alternatives would create less Class II lands than the inventory with the exception of B-2, which creates more. All alternatives would create less Class III Visual Resource Management lands than the visual resource inventory. Alternatives B-1, C, and D would create more Class IV Visual Resource Management lands than the visual resource inventory, while Alternative A would create less. Alternative B-2 would create the same amount of lands as Class IV as the inventory. Table 4-21 in Volume 2 provides a comparative analysis between the percent of the acres of inventory class versus the percent of the acres of Visual Resource Management classes.

4.7.19.5 Potential Mitigation Measure (New Best Management Practice)

The objective and requirement/standard would be the same as those described in section 4.3.19.5 in Volume 2. The potential benefits and residual/unavoidable impacts would be similar to those described for Alternative A at section 4.3.19.5 in Volume 2, yet within the context of the different Visual Resource Management classes designated in this alternative.

4.7.20 Economy

4.7.20.1 Activities Not Associated with Oil and Gas Exploration and Development

Impacts of non-oil and gas activities are likely to be the same as those for the other alternatives. The BLM estimates (Table 4-1 in Volume 2) up to 6 to 12 trips each made by 10 to 12 persons taking place each year. Employment generated by this activity would remain the same. Permitted commercial-guided activities will result in fees to the federal government. Operators or guides pay a total of at least $600 per year for BLM permits.

Other activities such as research or surveys, various ground activities, and aircraft use not related to petroleum are shown in Table 4-1 in Volume 2 and offshore later in section 4.2.1.1. The level of activities is expected to be similar to Alternative A. North Slope Borough residents may be employed in some of these activities, as will other Alaskans and non-residents.

4.7.20.2 Oil and Gas Exploration and Development Activities

In Alternative D, oil and gas exploration and development activities will increase revenue and employment over the life of the fields at a level higher than all other alternatives. Activities related to the discovered resources are expected to remain the same as described in Alternative A. Undiscovered oil and gas in this scenario would result in oil production of 491 million barrels and gas production of 16.8 trillion cubic feet. Peak oil production was modeled at 80 million barrels of oil per day, and gas production at 2.8 billion cubic feet per day. More drilling and construction are required than in the other alternative scenarios. Oil production will contribute to maintain the Trans-Alaska Pipeline System throughput above threshold for nearly 5 years at peak production, assuming a 270,000 barrels per day threshold and a 6 percent production decline rate.

Revenues

Revenues for the discovered resources are expected to remain as described in Alternative A, and for total resources. Bonus bids are expected to total $228 million, and average $7.6 million over a 30-year term. Exploration, development, and production activities for the undiscovered resources are estimated to generate property tax revenue to the North Slope Borough of nearly $5.7 billion over the period. Other local, State, and federal revenues are also anticipated to increase under this alternative. The estimated royalty payments split equally by the State of Alaska and the federal government total $19.5 billion. State corporation taxes will be $1.8 billion, and federal income tax will be $14.9 billion. In addition, State production taxes are estimated to be $6.6 billion. These estimates are based upon prices of $180 per barrel of oil and $8.67 per thousand cubic feet of gas, as explained in section 4.2.1 in Volume 2.

Total revenue data including discovered and undiscovered resources are presented below. Local, state, and federal government revenues total $61 billion for all the activities, and would average $2.2 billion if all activities occur simultaneously.

Table 4-31. Alternative D revenues (in millions of 2010 dollars)

	North Slope Borough		State of Alaska		Federal	
	Total	**Average annual***	**Total**	**Average annual***	**Total**	**Average annual***
Bonus bids**			114	3.8	114	3.8
Royalty			11,889	429.0	11,889	429.0
Property tax	6,145	221.0	683	25.0		
Corporate income tax			2,075	75.0	17,430	622.0
Production tax			10,683	378.0		
Totals	6,145	221.0	25,444	910.8	29,433	1,054.8

* If all projects occur simultaneously.

** Over next 30 years.

Employment

In this alternative, employment for the discovered resources will remain as described in Alternative A. Employment for the undiscovered resources will be higher than under the other alternative scenarios. Oil processing facilities will remain at 11, but the number of gas processing facilities will increase to 42. Other infrastructure will also increase.

Table 4-32 provides information on potential new or continued employment for both discovered and undiscovered oil and gas exploration, development, and production.

Table 4-32. Potential employment under Alternative D

	Alternative total	Annual average
Total for all places of residence	589,153	15,762
Direct	244,480	6,454
Indirect & Induced	344,673	9,308
North Slope Borough total	23,644	680
Direct	12,866	369
Indirect & Induced	10,778	311
Other Alaska total	461,622	12,305
Direct	170,495	4,471
Indirect & Induced	291,127	7,834
Outside Alaska total	104,250	2,777
Direct	61,121	1,613
Indirect & Induced	43.129	1,164

Other Effects of Oil and Gas Development

Under Alternative D, if health problems arise due to air or water pollution or other causes as described in section 3.4.12, "Public Health" (Volume 1), there would be increased economic costs both for individuals and government associated with concerns such as health care, social services, and law enforcement. If effects are common or pronounced under this level of development, economic costs will be higher than under the other alternatives.

Development under Alternative D could also contribute to some increase in the cost of engaging in subsistence activities. Costs would include fuel, supplies, equipment, and additional time, particularly as travel is increased, and may be higher than at the level of development in the other alternatives. Local earnings will be higher, which may offset some of the increased subsistence cost.

Alternative D is not likely to affect the cost of fuel or supplies for villages resulting from operation of ice roads. The chief executive officer of Kuukpik Corporation stated he could not see changes in economies resulting from the operation of ice roads. (Chinn 2007) Unless there is a gravel road connecting Nuiqsut or other North Slope villages to the state's road network, which is not anticipated as part of this IAP/EIS, it is unlikely that costs would change significantly.

With the possible exception of services related to health, social services, and law enforcement noted above, infrastructure costs, including schools and local airports, are not likely to be affected by development under Alternative D. North Slope oil fields are largely self-sufficient for emergency services and health and social services. For example, oil facilities typically include emergency medical technicians, clinical facilities, and emergency transportation. Air traffic from oil and gas development will be directed toward oil field airstrips, not community airports. Local property taxes will be the highest under this alternative, and may allow some expansion of local services and infrastructure.

4.7.20.3 Conclusion

Most revenues and employment generated by oil and gas exploration and development under Alternative D would be greater than under the other alternatives. Oil and gas exploration and development would benefit the local, State, and national economy by increasing revenues and employment. Over $61 billion would flow to all levels of government. There would be $29.4 billion for the federal government, $25.4 billion for the State of Alaska, and $6.1 billion for the North Slope Borough. The number of jobs created by exploration, development, and production would total 589,153 direct and indirect over the life of all projects. An average of 680 North Slope Borough resident jobs would be added or continued if discovered and undiscovered resources were developed simultaneously. Increased costs to harvest subsistence resources could affect the economic well-being of North Slope Borough residents, primarily through increased costs to reach subsistence resources, and this effect would be the highest of all alternatives. The added cost could be offset to some degree by increased employment income.

4.7.21 Public Health

4.7.21.1 Activities Not Associated with Oil and Gas Exploration and Development

The activities not associated with oil and gas exploration and development are described in section 4.2.1.1 in Volume 2, and include aircraft use, river trips and other recreational uses, site cleanup and remediation activities, overland moves, archeological surveys and site work. The level of such activity will be the same under Alternative D as it is under Alternative A.

Such activities should not have a significant impact on public health. Localized impacts on subsistence are likely, primarily as a result of displacement of animals due to aircraft noise. In addition, the presence of temporary camps may affect subsistence regardless of whether these cause displacement of animals, as a result of the avoidance of the area by hunters seeking to minimize conflict. These impacts are described in section 4.7.13. The effect of such activities is likely to be localized and temporary.

Alterations in the success of subsistence activities can impact health by way of nutritional outcomes and risk of injury. The mechanisms of these effects are described in section 4.3.21.2 in Volume 2. For any individual affected, the impact of an unsuccessful hunt or an accident or injury on the land could be severe. However, given the transient and highly localized nature of these activities, it is unlikely that they will have any overall impact on public health.

4.7.21.2 Oil and Gas Exploration and Development Activities

The oil and gas exploration activities described in section 4.2.1.2 in Volume 2 may lead to alterations in public health and safety via a number of different pathways. These include diet and nutrition, environmental exposures, infectious disease, safety, acculturative stress, economic impacts, and capacity of local health care services. For details of these pathways and a description of how they impact health see section 4.3.21.2 in Volume 2. The potential impacts of Alternative D on each pathway are described below.

Diet and Nutrition

The likelihood of impacts to subsistence harvests under Alternative D is discussed in section 4.7.13. As is the case with Alternative A, Nuiqsut, Atqasuk, and Barrow would be the most impacted communities, as these villages obtain most of their non-marine traditional food from the affected lands. Wainwright and Anaktuvuk Pass will be affected to a lesser degree, as they depend somewhat on fish and caribou harvested from potentially affected areas within the NPR-A. Any reductions in the success of the harvests of these species in any village would accelerate the transition from subsistence resources to store-bought foods, worsening nutritional outcomes and food insecurity. As compared to the other alternatives, the level of activity and the wide distribution of exploration and development under Alternative D increase the likelihood and severity of health impacts resulting from changes in diet and nutrition, and will exacerbate the current trends away from a traditional diet. Protection of areas of high surface resource value will partially protect subsistence activity, and thus, temper the impacts to food insecurity and nutritional outcomes.

Nuiqsut hunters, who already avoid large areas of traditional land to the northeast of the village, could experience further limitation in their access to lands to the south and west of the village if intensive oil and gas development occurs there. Avoidance of productive land may reduce harvests and exacerbate dietary and nutritional outcomes independent of any direct impact on the animals themselves. Under Alternative D, Nuiqsut hunters may over time become dependent on a severely limited land base for subsistence activity and will become vulnerable to fluctuations in the success of harvests.

Environmental Exposures

Health effects from environmental exposures under Alternative D will follow the same pathways as for Alternative A, described in section 4.3.21.2 in Volume 2. The overall impact of air quality on human health is likely to remain low. However, people who are particularly vulnerable to respiratory problems (such as children, the elderly, and people with certain chronic illnesses) may experience health problems at locations or during events with poorer air quality. Permanent facilities in close proximity to villages or cabins may episodically affect air quality. Water contamination from runoff, spills, or discharges is unlikely to cause health effects under Alternative D. However, if water contamination reaches a drinking water supply for residences or people on the land, acute or chronic health effects may ensue, depending on the nature of the contaminant and the level and duration of exposure. In absence of a major accidental release, contaminant levels in traditional foods are likely to remain below levels that would trigger public health concern. Environmental noise may cause annoyance or sleep disturbance for those who experience it; this is most likely to be people on the land or in cabins who are affected by helicopter traffic or overflights.

Alternative D opens up all BLM-managed lands in the NPR-A to oil and gas development and heightens the likelihood of conflict between subsistence and industrial uses of the land. As a result, environmental exposures are likely to be greater than with the other alternatives. Intermittent exposure is possible in wide areas of the NPR-A where development and subsistence use overlap. The extent of oil and gas activity is likely to exacerbate perceptions of contamination and undermine confidence in the safety of traditional foods.

Infectious Disease

Under Alternative D, as with Alternative A, a continued in-migration of oil industry workers from communities outside of the North Slope will present a risk of infectious disease transmission. The character and extent of this impact will be the same for all alternatives, varying only to the degree to which individual project characteristics increase the number of outside workers and the degree to which they fraternize with the local population. The nature of this impact is described in section 4.3.21.2 in Volume 2. The level of activity under Alternative D may lead to higher levels of infectious disease if it results in a greater number of outside workers traveling through the region or if more local residents take jobs in oil and gas work camps.

Safety

As with Alternative A, under Alternative D, the main impact on safety will result from local alterations in travel patterns for subsistence activity. Noise from overflights in any area of exploration or development will cause temporary displacement of caribou and birds, and may require hunters to travel farther from their camps and cabins. These impacts will be localized and temporary, but may intermittently impact a large number of users of the land, particularly in the northeast region of the NPR-A, where exploration and development is likely to be the most intense.

Under all alternatives, any further development of fixed facilities in areas of traditional use is likely to result in voluntary displacement of subsistence. Given the current impact of

Alpine on the land-use patterns of Nuiqsut hunters, any further development in close proximity to that community will substantially increase their travel distances and the subsequent risk of injury.

Acculturative Stress

Under Alternative D, as with Alternative A, the current trends in acculturation and its subsequent health impacts are likely to continue. The availability of a larger amount of land for leasing under Alternative D may lead to a more rapid expansion of oil and gas activity in the region and create conflict with subsistence and other traditional uses of the land, thus accelerating the rate of acculturation and its subsequent health impacts.

Under all alternatives, the isolation of outside workers into segregated work camps and the low levels of direct Iñupiat employment in the oil and gas industry will continue to provide some protection against acculturative stress. Villages where industrial activity occurs in close proximity will be at greatest risk, particularly if there is more open access between the local population and the work camps.

Economic Impacts

Health impacts from economic conditions are likely to be the similar under all alternatives. Revenue to the North Slope Borough and village corporations will allow for the continued funding of existing health and social programs and the preservation of the current high level of indirect employment. New jobs in the oil and gas sector will continue to be created, though too few will go to Iñupiat workers to create any local health benefit. Increases in alcohol, drug use, and sexually transmitted infections will be expected, commensurate with the level of economic growth and the degree of contact between outside workers and local populations. If more intense development occurs under Alternative D, it will increase the negative impact rapid economic growth has on public health.

Health Care Services

The impact on health care services under Alternative D will be largely the same as under Alternative A (see section 4.3.21.2 in Volume 2). Tax revenues from ongoing exploration and development will support the continued provision of the current level of health care services in the North Slope Borough, and should not significantly impact demand. Increased occurrences of injury and trauma (see safety, above) will be sporadic and will be well within the capacity of acute care and search and rescue services in Barrow. The likelihood of an increase in demand for health care services under Alternative D is low. Increased revenues to the North Slope Borough may allow for further program development and more liberal spending on health care, however, it is unlikely that such increases would have a measurable impact on public health.

4.7.21.3 Effectiveness of Stipulations and Best Management Practices

The management actions described in section 2.2 and the stipulations and best management practices described in section 2.8 (both in Volume 1) provide a number of important protections for public health and safety. For a description of the effectives of stipulations and best management practices relevant to Alternative D, please see section 4.3.21.3 in Volume 2. The lack of provisions in Alternative D for caribou movement corridors in the Teshekpuk Lake and Southern Herd areas (Best Management Practices K-9, K-10) may diminish protections for human health insofar as subsistence success is affected.

4.7.21.4 Conclusion

The pathways for health impacts in Alternative D are the same as those in Alternative A. However, under Alternative D, the general trends in public health in the North Slope Borough will continue and may accelerate. The transition in the burden of disease from one in which infectious disease predominated to one in which chronic disease is the primary driver of ill-health will progress among the Iñupiat, as it has in other indigenous populations. As is the case with other subsistence-dependent Arctic regions, injuries and trauma will continue to carry a disproportionate share of morbidity and mortality when compared to the general Alaska and U.S. populations, and the risk of injury and trauma may also be exacerbated if climate change results in unusual or unpredictable weather, water, snow, and ice conditions that make travel more hazardous (Brubaker 2011), and dislocation of subsistence species require people to travel greater distances to find marine or land mammals or edible plants.

Oil and gas activities contribute to these trends and impact public health in a number of ways. The preservation and promotion of traditional uses of the land is a public health priority, both for the nutritional benefits associated with a subsistence diet and for the social cohesion and cultural value associated with traditional Iñupiat practices. Though economic development provides important health benefits through both individual employment and revenues to local governments, these benefits are balanced against the risks that result from an erosion of traditional culture and diet and exposures to environmental contaminants, social ills, and infectious disease. The focus on development under Alternative D will lead to worsened public health outcomes both from an accelerated transition away from traditional diet and culture, as well as an increase in the ill effects of rapid economic growth.

Under Alternative D, as is the case with all alternatives, localized exploration activity will create transient impacts on subsistence by way of diversion of hunters and animals. In addition, noise from air traffic and other sources will create a nuisance around individuals' camps and cabins. Potential contamination of food and surface water is possible, though measurable public health impacts resulting from such contamination are unlikely under normal operating conditions. However, the perception of contamination of traditional foods is already a problem in the region. Further development around villages and in areas of traditional land use under Alternative D will be widespread and will likely worsen this perception, potentially exacerbating the shift away from a subsistence diet.

Fixed production sites, particularly those in the vicinity of villages and in areas of heavy subsistence use of the land, will have an impact on public health under Alternative D. The avoidance of developed areas by hunters increases travel times and costs associated with subsistence activity, and as a result, will potentially decrease harvests and increase the risk of injury and accidents while on the land. Episodes of poor air quality associated with dust or emissions will pose a health hazard for at-risk populations such as those suffering from chronic obstructive pulmonary disease or asthma.

The economic impact of activity under Alternative D will allow for a continuation of funding for current levels of services and maintenance of the current level of indirect employment, particularly through the North Slope Borough. Given current conditions, it is unlikely that new employment for the Iñupiat in the oil and gas sector will be significant enough to positively impact public health, though jobs for the individuals who get them will be an important health determinant. The health risks associated with economic growth and in-migration, namely increased use and access to alcohol and drugs and the spread of infectious disease and sexually transmitted diseases will be commensurate with the level of employment, road access, and the degree to which outside workers fraternize with local populations. The continued focus on the development of isolated work camps will temper these impacts, however, if there is rapid and widespread expansion in oil and gas activity under Alternative D, public health is likely to be adversely impacted.

4.7.21.5 Potential New Mitigation Measure (new best management practice)

The objective and requirement/standard for all potential new public health mitigation measures would be the same as those described in section 4.3.21.5 in Volume 2. The potential benefits and residual/unavoidable impacts would be similar to those described for Alternative A at section 4.3.21.5.

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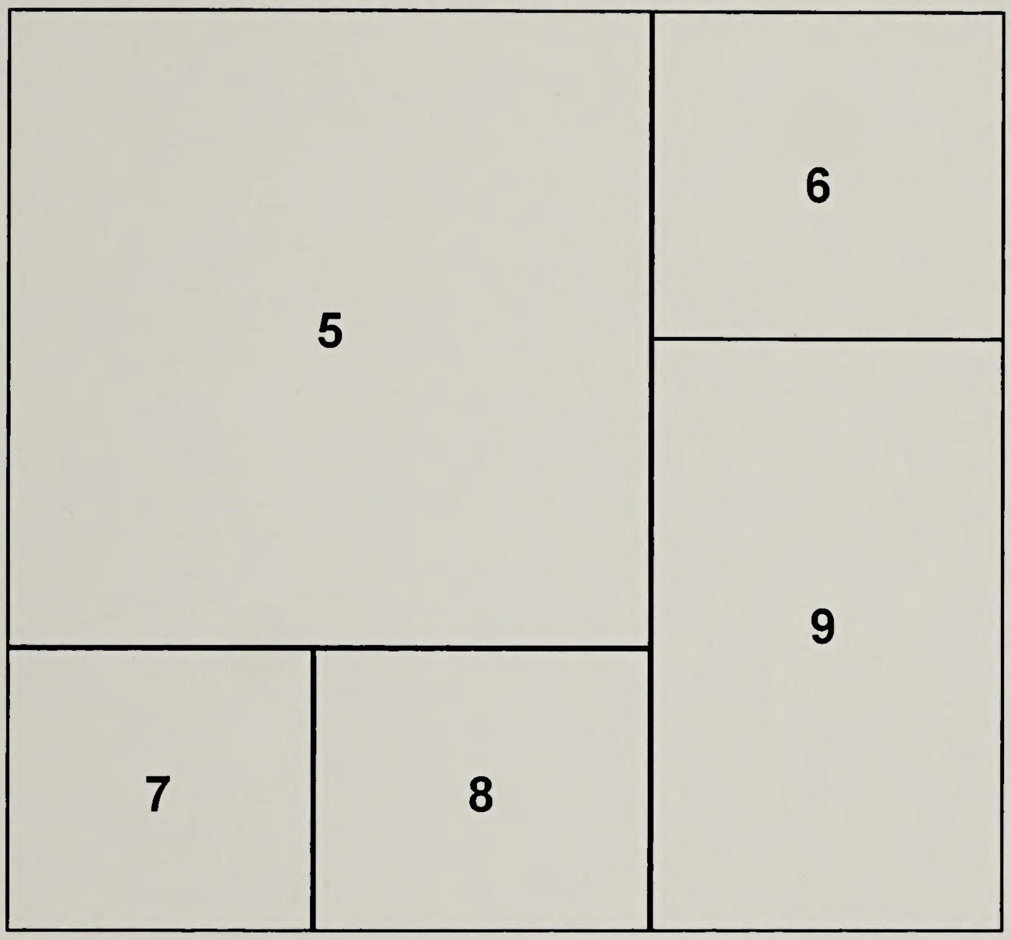

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